2003 STEERING

Power Steering System - Blazer, S10, Jimmy & Sonoma

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

Application	Specification	
	Metric	English
A/C Compressor Mounting Bolts (2.2L)	50 N·m	37 lb ft
A/C Compressor Rear Bracket Mounting Bolts (2.2L)	31 N·m	23 lb ft
Accessory Mounting Bracket Mounting Bolts and Nut	50 N·m	37 lb ft
Coupling Shield Retainer and Lock Nut	109 N·m	80 lb ft
Filler Neck Tube Bolt (4.3L)	20 N·m	15 lb ft
Front Differential Carrier Shield Bolts	25 N·m	18 lb ft
Hood Latch Support Mounting Bolts	25 N·m	18 lb ft
Lower Intermediate Shaft Coupling Bolt	35 N·m	26 lb ft
Pitman Arm Ball Stud to Relay Rod Nut (4WD)	83 N·m	61 lb ft
Pitman Arm Nut	250 N·m	184 lb ft
Pitman Shaft Over-Center Preload[1]	0.7–1.1 N·m[1]	6–10 lb in[1]
Power Steering Cooler Retaining Bolts	10 N·m	7 lb ft
Power Steering Gear Adjuster Lock Nut	49 N·m	36 lb ft
Power Steering Gear Adjuster Nut Assembly	30 N·m	22 lb ft
Power Steering Gear Side Cover Bolts	60 N·m	45 lb ft
Power Steering Gear to Frame Mounting Bolts	75 N·m	55 lb ft
Power Steering Hose Clamps	2 N·m	18 lb in
Power Steering Pressure Hose to Power Steering Gear (2.2L)	25 N·m	18 lb ft
Power Steering Pressure Hose to Power Steering Gear (4.3L)	30 N·m	22 lb ft
Power Steering Pump Flow Control Valve Connector and Fitting Assembly	75 N·m	55 lb ft
Power Steering Pump Front Mounting Bolts (2.2L)	30 N·m	22 lb ft
Power Steering Pump Front Mounting Bolts (4.3L)	50 N·m	37 lb ft
Power Steering Pump Front Mounting Nut (4.3L)	41 N·m	31 lb ft
Power Steering Pump Mounting Studs	57 N·m	42 lb ft
Power Steering Pump Rear Mounting Bracket Bolt (2.2L)	50 N·m	37 lb ft
Power Steering Pump Rear Mounting Bracket Nuts (2.2L)	50 N·m	37 lb ft
Power Steering Pump Rear Mounting Bracket Nut (4.3L)	41 N·m	31 lb ft
Power Steering Return Hose to Power Steering Gear	25 N·m	18 lb ft
Power Steering Return Hose to Power Steering Pump	25 N·m	18 lb ft
Rack Piston Guide Clamp Screw	6 N·m	53 lb in
Rack Piston Plug	150 N·m	111 lb in

[1]This specification is in addition to the worm shaft thrust bearing preload and the valve and seal drag.

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Fig. 1: Fastener Tightening Specification
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POWER STEERING PUMP SPECIFICATIONS

Engine Code	Engine Size	High Flow		Pressure Relief	
		Liters Per Minute	Gallons Per Minute	kPa	PSI
L43	2.2L	9.1/10.6	2.4/2.8	7585/8274	1100/1200
L35	4.3L	9.5/11	2.5/2.9	7585/8274	1100/1200

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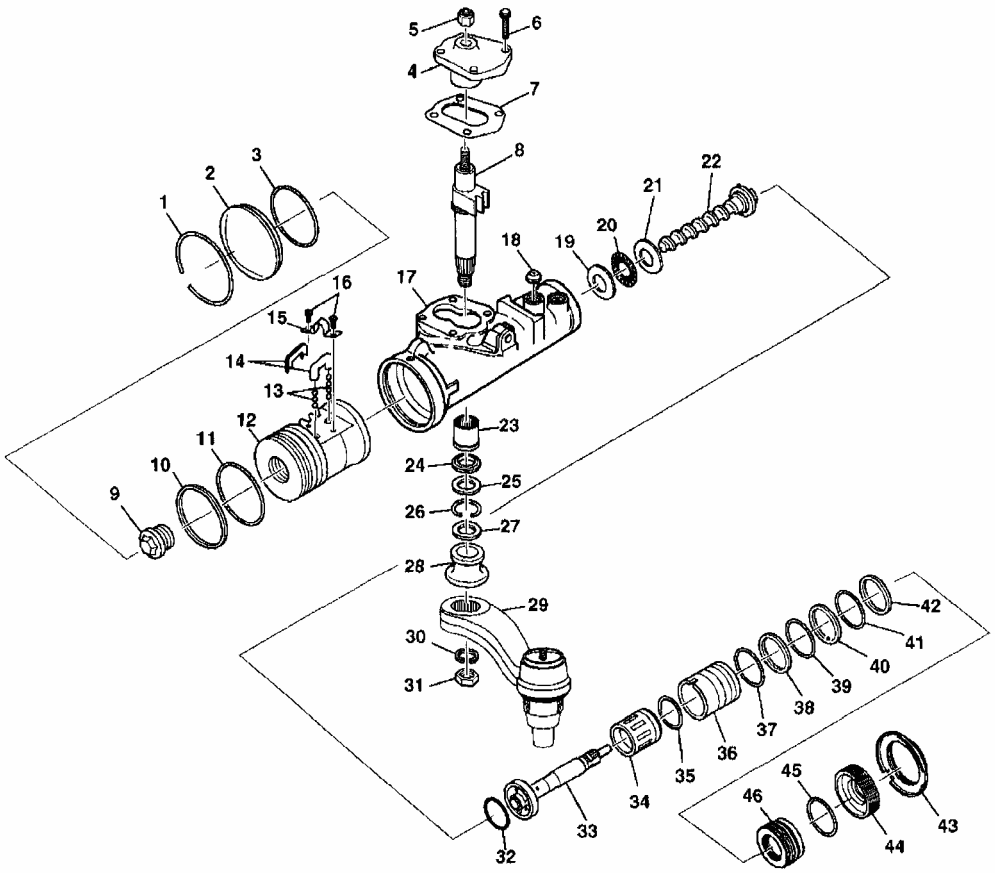
Fig. 2: Power Steering Pump Specification
Courtesy of GENERAL MOTORS CORP.

COMPONENT LOCATOR

POWER STEERING GEAR DISASSEMBLED VIEW (700 GEAR)



(1) Retaining Ring
(2) Plug
(3) O-ring Seal
(4) Side Cover
(5) Adjuster Lock Nut
(6) Bolt
(7) Gasket
(8) Pitman Shaft
(9) Steering Gear Housing End Plug
(10) Teflon Ring
(11) O-ring Seal
(12) Rack Piston
(13) Balls
(14) Ball Guide
(15) Clamp
(16) Screw
(17) Housing
(18) Check Valve
(19) Flat Race
(20) Thrust Bearing
(21) Flat Race
(22) Worm Shaft
(23) Needle Bearing
(24) Pitman Shaft Seal
(25) Backup Washer
(26) Retaining Ring
(27) Dust Seal
(28) Pitman Shaft Boot
(29) Pitman Shaft Arm
(30) Lock Washer
(31) Nut
(32) Seal
(33) Stub Shaft
(34) Valve Spool
(35) Seal
(36) Valve Body
(37) O-ring Seal
(38) Valve Body Ring
(39) O-ring Seal
(40) Valve Body Ring
(41) O-ring Seal
(42) Valve Body Ring
(43) Coupling Shield Retainer and Lock Nu
(44) Adjuster Nut Assembly
(45) O-ring Seal
(46) Thrust Support Assembly

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Fig. 3: Power Steering Gear
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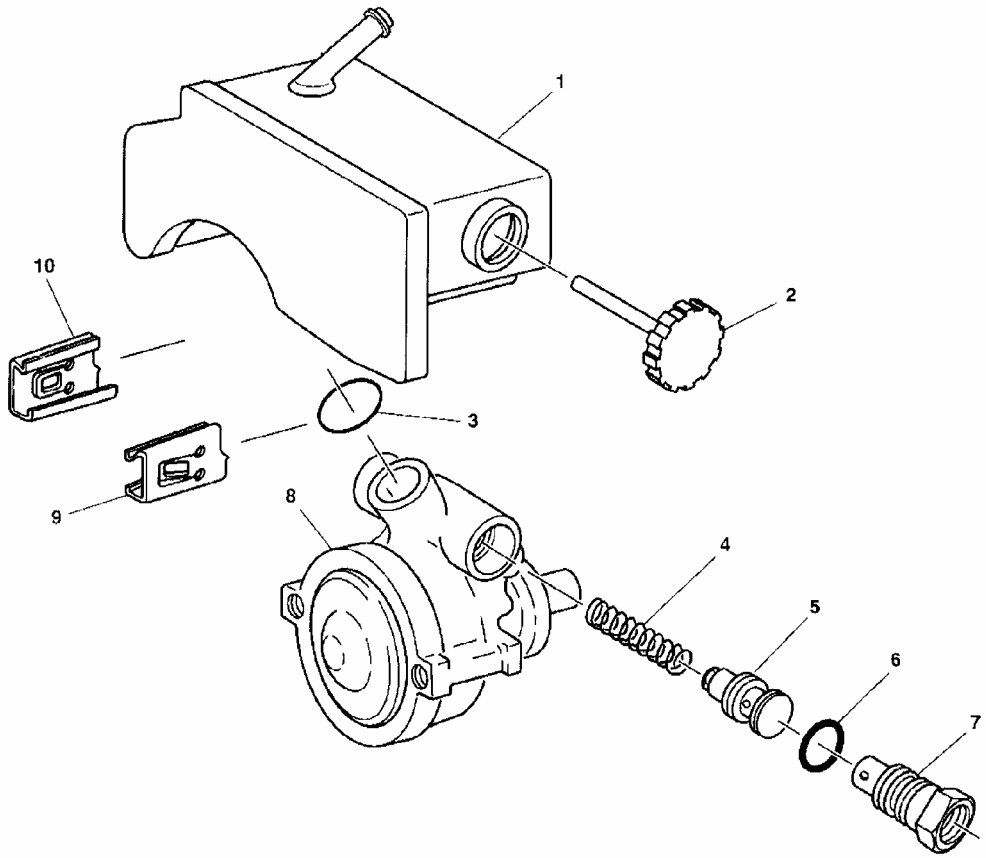
POWER STEERING PUMP DISASSEMBLED VIEW (CB SERIES)



(1) Hydraulic Pump Reservoir
(2) Reservoir Capstick Assembly
(3) O-Ring Seal
(4) Flow Control Spring
(5) Control Valve Assembly
(6) O-Ring Seal
(7) Connector and Fitting Assembly
(8) Hydraulic Pump Housing Assembly
(9) Reservoir Retaining Clip (RH)
(10) Reservoir Retaining Clip (LH)

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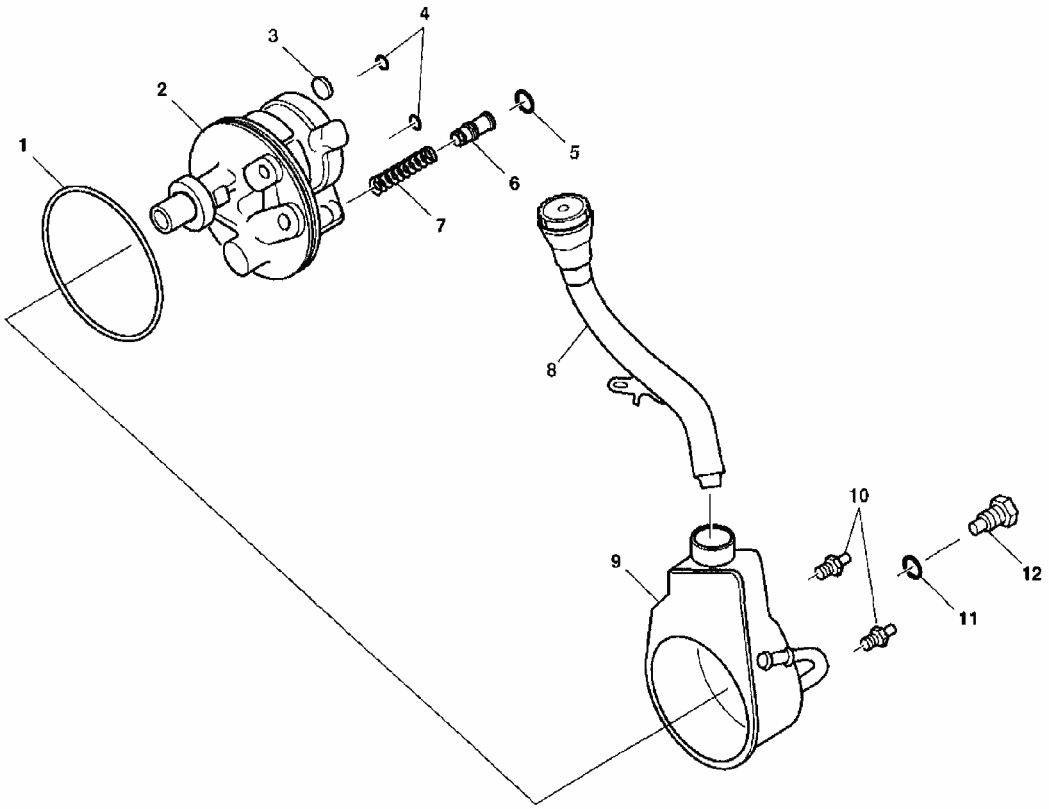
Fig. 4: S/T Truck CB Series Power Steering Pump Reservoir
Courtesy of GENERAL MOTORS CORP.

POWER STEERING PUMP DISASSEMBLED VIEW (P SERIES)



(1) O-ring Seal
(2) Hydraulic Pump Housing Assembly
(3) Magnet
(4) O-ring Seals
(5) Rectangular Section Seal
(6) Control Valve Assembly
(7) Flow Control Spring
(8) Reservoir Capstick Assembly
(9) Hydraulic Pump Reservoir Assembly
(10) Mounting Studs
(11) O-ring Seal
(12) Connector and Fitting Assembly

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Fig. 5: S/T Truck Power Steering Pump Reservoir
Courtesy of GENERAL MOTORS CORP.

DIAGNOSTIC INFORMATION AND PROCEDURES

DIAGNOSTIC STARTING POINT - POWER STEERING SYSTEM

Begin the system diagnosis by reviewing the system Description and Operation. Reviewing the Description and Operation information will help you determine the correct symptom diagnostic procedure when a malfunction exists. Reviewing the Description and Operation information will also help you determine if the condition described by the customer is normal operation. Refer to **SYMPTOMS - POWER STEERING SYSTEM** in order to identify the correct procedure for diagnosing the system and where the procedure is located.

SYMPTOMS - POWER STEERING SYSTEM

Review the system description and operation in order to familiarize yourself with the system functions. Refer to **POWER STEERING SYSTEM DESCRIPTION AND OPERATION** .

Visual/Physical Inspection

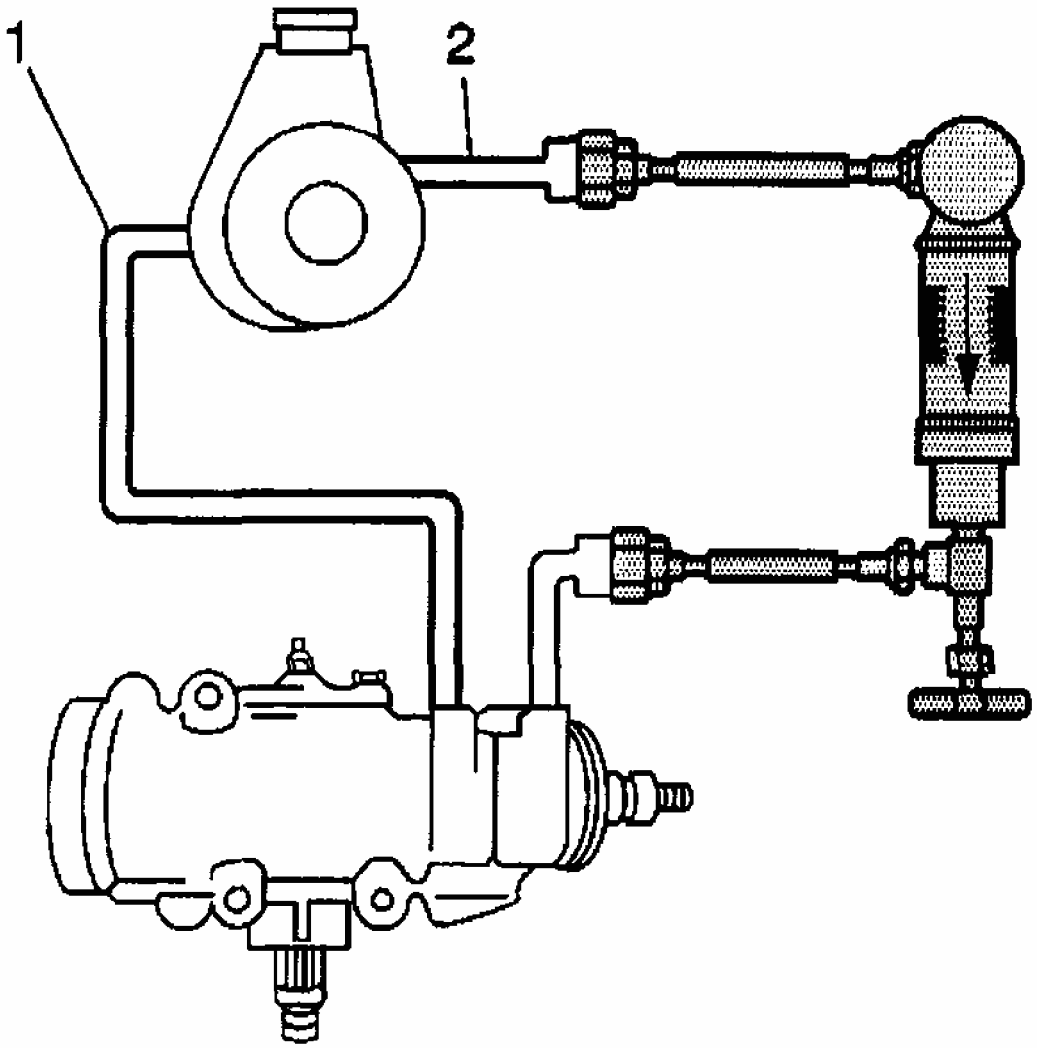
- Inspect for aftermarket devices which could affect the operation of the power steering system.
- Inspect the easily accessible or visible system components for obvious damage or conditions which could cause the symptom.
- Inspect the power steering reservoir for the proper power steering fluid level and condition.

Symptoms List

Refer to a symptom diagnostic procedure from the following list in order to diagnose the symptom:

- **POWER STEERING FLUID LEAKS**
- **RATTLE, CLUNK, OR SHUDDER NOISE FROM THE POWER STEERING SYSTEM**
- **WHINE OR GROWL NOISE FROM THE POWER STEERING SYSTEM**
- **STEERING EFFORT HARD IN ONE OR BOTH DIRECTIONS**
- **STEERING EFFORT TOO EASY IN ONE OR BOTH DIRECTIONS**

POWER STEERING SYSTEM TEST PROCEDURE



(1) Power Steering Return Hose
(2) Power Steering Pressure Hose

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Fig. 6: Identifying Power Steering Return Hose & Pressure Hose
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Test Description

The numbers below refer to the step numbers on the diagnostic table.

3. This step tests the system for restrictions.

5. This step tests the following components for the following conditions:
   - The pump for internal leaks
   - The power steering pipes for kinks
6. This step tests the ability of the pump to regulate flow at maximum pressure.
8. This step tests the ability of the pump to regulate flow under normal operating conditions.
10. This step tests the internal components of the pump and the gear.

Step	Action	Value(s)	Yes	No
Notice: If the power steering system has been serviced, an accurate fluid level reading cannot be obtained unless air is bled from the steering system. The air in the fluid may cause pump cavitation noise and may cause pump damage over a period of time. **Important:** In order to accurately diagnose the system, the malfunction must be present during the test procedure.				
DEFINITION: The Power Steering System Test Procedure will perform the following functions: • Test the operation of the hydraulic power steering • Test the operation of the power steering pump and power steering gear • Identify restrictions in the system				
1	1. Turn the ignition switch to the OFF position. 2. Place a drain pan under the vehicle in order to catch any power steering fluid. 3. Disconnect the power steering pressure pipe/hose from the power steering pump or the power steering gear as necessary. 4. Install the *J 44721* Power Steering System Analyzer between the power steering pump and the power steering gear on the pressure side. Adapters may be required. 5. Inspect and add ONLY approved power steering fluid as necessary in order to ensure that the power steering fluid is at the proper level and not contaminated. Refer to *Checking and Adding Power Steering Fluid*. Is the fluid at the proper level and free from contamination?	—	Go to *Step 3*	Go to *Step 2*
2	Fill or drain and refill the fluid as necessary. Refer to *Checking and Adding Power Steering Fluid*. Is the fluid at the proper level and free from contamination?	—	Go to *Step 3*	—
3	1. Fully open the *J 44721* valve. 2. Start the engine. ***Notice:*** Refer to *Steering Wheel in the Full Turn Position Notice* in Cautions and Notices. 3. Turn the steering wheel and BRIEFLY hold the steering wheel against the steering stop in order to release any trapped air from the system. 4. Inspect and ensure that all of the power steering pipe/hose connections are not leaking. 5. Observe the pressure reading. Is the pressure reading greater than the specified value?	1379 kPa (230 psi)	Go to *Step 4*	Go to *Step 5*
4	**Important:** A restriction may be present in the power steering system. Turn off the engine IMMEDIATELY. Locate and repair the restriction. Did you complete the repair?	—	Go to *Step 16*	—
5	1. Inspect and add ONLY approved power steering fluid as necessary in order to ensure that the power steering fluid is at the proper level. Refer to *Checking and Adding Power Steering Fluid*. 2. Allow the engine to run until the engine reaches full operating temperature. 3. Record the pressure reading and flow reading (A). 4. Partially close the *J 44721* valve until the system pressure reaches the specified value, then record the FLOW reading (B). 5. Subtract flow reading B from flow reading A. Is the flow DECREASE greater than 3.8 L (1 gal) per minute?	4827 kPa (700 psi)	Go to *Step 11*	Go to *Step 6*

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Fig. 7: Power Steering System Test Procedure (1 Of 3)
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Step	Action	Value(s)	Yes	No
6	***Notice:*** Do not leave the valve fully closed for more than 5 seconds, or the pump could be damaged internally. Fully close then open the *J 44721* valve 3 times. Record all of the high pressure readings. Refer to *Power Steering Pump Specifications* for power steering system pressure relief specifications. Are the 3 high pressure readings within specifications?	—	Go to *Step 7*	Go to *Step 13*
7	Are the 3 high pressure readings within 245 kPa (50 psi) of each other?	—	Go to *Step 8*	Go to *Step 12*
8	1. Increase the engine speed to approximately 1500 RPM. 2. Record the flow reading. Refer to *Power Steering Pump Specifications* for power steering system pressure specifications. Is the actual flow reading within specifications?	—	Go to *Step 9*	Go to *Step 11*
9	Is the difference between the actual flow reading and the maximum flow specification more than 3.8 L (1 gal) per minute?	—	Go to *Step 14*	Go to *Step 10*
10	***Notice:*** Refer to *Steering Wheel in the Full Turn Position Notice* in Cautions and Notices. Turn the steering wheel from steering stop to steering stop and record the FLOW readings at each stop. Is the flow LOWER than 3.8 L (1 gal) per minute?	—	Go to *Step 17*	Go to *Step 15*
11	Replace the power steering pump. Refer to *Power Steering Pump Replacement (2.2L)* or *Power Steering Pump Replacement (4.3L)*. Did you complete the replacement?	—	Go to *Step 16*	—
12	1. Remove the power steering pump flow control valve. Refer to *Power Steering Pump Flow Control Valve Replacement - Off Vehicle (CB Series)* or *Power Steering Pump Flow Control Valve Replacement - Off Vehicle (P Series)*. 2. Inspect the flow control valve. If any burrs or scratches are noticed on the flow control valve, replace the flow control valve. Do NOT attempt to clean the flow control valve. Refer to *Power Steering Pump Flow Control Valve Replacement - Off Vehicle (CB Series)* or *Power Steering Pump Flow Control Valve Replacement - Off Vehicle (P Series)*. 3. Inspect the flow control valve bore. If any burrs or scratches are present in the control valve bore, replace the power steering pump. Refer to *Power Steering Pump Replacement (2.2L)* or *Power Steering Pump Replacement (4.3L)*. Did you complete the repair?	—	Go to *Step 16*	—
13	Replace the power steering pump flow control valve. Refer to *Power Steering Pump Flow Control Valve Replacement - Off Vehicle (CB Series)* or *Power Steering Pump Flow Control Valve Replacement - Off Vehicle (P Series)*. Did you complete the replacement?	—	Go to *Step 16*	—

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Fig. 8: Power Steering System Test Procedure (2 Of 3)
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Step	Action	Value(s)	Yes	No
14	1. Remove the power steering pump flow control valve and inspect for any wear or damage. Do NOT disassemble the flow control valve. 2. If the flow control valve is worn damaged, replace the flow control valve. Refer to *Power Steering Pump Flow Control Valve Replacement - Off Vehicle (CB Series)* or *Power Steering Pump Flow Control Valve Replacement - Off Vehicle (P Series)*. Did you complete the repair?	—	Go to *Step 16*	—
15	The power steering gear is leaking across the piston or bypassing the valve circuit. Replace the power steering gear. Refer to *Power Steering Gear Replacement (RWD)* or *Power Steering Gear Replacement (4WD)*. Did you complete the replacement?	—	Go to *Step 16*	—
16	Test the power steering system for the original condition. Does the original condition still exist?	—	Go to *Step 1*	Go to *Step 17*
17	1. Disconnect and remove the *J 44721* from the vehicle. 2. Connect the vehicle power steering pipes/hoses. 3. Bleed the power steering system and add fluid as necessary. Refer to *Bleeding the Power Steering System*. Did you complete the repair?	—	System OK	—

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Fig. 9: Power Steering System Test Procedure (3 Of 3)
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POWER STEERING FLUID LEAKS

Step	Action	Yes	No
1	Did you review the Power Steering System General Description and perform the necessary inspections?	Go to *Step 2*	Go to *Symptoms - Power Steering System*
2	Verify that power steering fluid leaks are present. Is the power steering system leaking?	Go to *Step 3*	System OK
3	Inspect the power steering system fittings. Are the fittings leaking?	Go to *Step 10*	Go to *Step 4*
4	Inspect the power steering hoses. Are the hoses leaking?	Go to *Step 11*	Go to *Step 5*
5	Inspect the power steering pump and the reservoir for leaks. Is the power steering pump or reservoir leaking?	Go to *Step 10*	Go to *Step 6*
6	Inspect the power steering gear for leaks. Is the power steering gear leaking?	Go to *Step 11*	Go to *Step 7*
7	Inspect the power steering cooler for leaks. Is the power steering cooler leaking?	Go to *Step 12*	Go to *Step 3*
8	Tighten the fittings. Refer to *Fastener Tightening Specifications*. Did you complete the repair?	Go to *Step 13*	—

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Fig. 10: Power Steering Fluid Leakage (1 Of 2)
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Step	Action	Yes	No
9	Replace the power steering hoses. Refer to the appropriate procedure(s): • *Power Steering Cooler Pipe/Hose Replacement (2.2L)* or *Power Steering Cooler Pipe/Hose Replacement (4.3L)* • *Power Steering Pressure Hose Replacement (2.2L)* or *Power Steering Pressure Hose Replacement (4.3L)* • *Power Steering Return Hose Replacement (2.2L)* or *Power Steering Return Hose Replacement (4.3L)* Did you complete the repair?	Go to *Step 13*	—
10	Replace the power steering pump or reservoir. Refer to *Power Steering Pump Replacement (2.2L)* or *Power Steering Pump Replacement (4.3L)* or *Power Steering Reservoir Replacement - Off Vehicle (CB Series)* or *Power Steering Reservoir Replacement - Off Vehicle (P Series)*. Did you complete the repair?	Go to *Step 13*	—
11	Replace the power steering gear. Refer to *Power Steering Gear Replacement (RWD)* or *Power Steering Gear Replacement (4WD)*. Did you complete the repair?	Go to *Step 13*	—
12	Replace the power steering cooler. Refer to *Power Steering Cooler Replacement (2.2L)* or *Power Steering Cooler Replacement (4.3L)*. Did you complete the repair?	Go to *Step 13*	—
13	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to *Step 3*

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Fig. 11: Power Steering Fluid Leakage (2 Of 2)
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RATTLE, CLUNK, OR SHUDDER NOISE FROM THE POWER STEERING SYSTEM

Step	Action	Yes	No
1	Did you review the Power Steering System General Description and perform the necessary inspections?	Go to *Step 2*	Go to *Symptoms - Power Steering System*
2	Verify that a rattle, clunk or shudder noise is present. Is a rattle, clunk or shudder noise present?	Go to *Step 3*	System OK
3	Inspect the power steering hoses for proper routing and clearance. Is the routing or clearance of the power steering hoses incorrect?	Go to *Step 12*	Go to *Step 4*
4	Inspect the engine drive belt for cracking or excessive wear. Refer to *Drive Belt Excessive Wear Diagnosis* in Engine Mechanical 2.2L or *Drive Belt Excessive Wear Diagnosis* in Engine Mechanical 4.3L. Is the drive belt cracked or excessively worn?	Go to *Step 13*	Go to *Step 5*
5	Inspect the power steering pump pulley for damage. Is the power steering pump pulley damaged?	Go to *Step 14*	Go to *Step 6*
6	Inspect the power steering pump and the power steering mounting bracket/brace for the proper installation. Refer to *Power Steering Pump Replacement (2.2L)* or *Power Steering Pump Replacement (4.3L)*. Is the power steering pump installation incorrect?	Go to *Step 15*	Go to *Step 7*
7	Inspect the power steering gear for the proper installation. Refer to *Power Steering Gear Replacement (RWD)* or *Power Steering Gear Replacement (4WD)*. Is the power steering gear installation incorrect?	Go to *Step 16*	Go to *Step 8*

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Fig. 12: Rattle, Clunk, Or Shudder Noise From Power Steering System (1 Of 2)
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Step	Action	Yes	No
8	Inspect the steering gear bearing preload for the proper adjustment. Refer to *Worm Thrust Bearing Preload Adjustment - Off Vehicle (700 Gear)*. Is the steering gear bearing preload adjustment incorrect?	Go to *Step 17*	Go to *Step 9*
9	Inspect the steering linkage. Refer to *Steering Linkage Inspection* in Steering Linkage. Is the steering linkage worn?	Go to *Step 18*	Go to *Step 10*
10	Inspect the suspension. Is the suspension worn?	Go to *Step 19*	Go to *Step 11*
11	Inspect the intermediate shaft. Is the intermediate shaft worn?	Go to *Step 20*	Go to *Step 3*
12	Adjust or replace the hoses. Refer to the appropriate procedure(s): • *Power Steering Cooler Pipe/Hose Replacement (2.2L)* or *Power Steering Cooler Pipe/Hose Replacement (4.3L)* • *Power Steering Pressure Hose Replacement (2.2L)* or *Power Steering Pressure Hose Replacement (4.3L)* • *Power Steering Return Hose Replacement (2.2L)* or *Power Steering Return Hose Replacement (4.3L)* Did you complete the repair?	Go to *Step 21*	—
13	Replace the engine drive belt. Refer to *Drive Belt Replacement* in Engine Mechanical 2.2L or *Drive Belt Replacement* in Engine Mechanical 4.3L. Did you complete the repair?	Go to *Step 21*	—
14	Replace the power steering pump pulley. Refer to *Power Steering Pulley Replacement*. Did you complete the repair?	Go to *Step 21*	—
15	Install the power steering pump correctly. Refer to *Power Steering Pump Replacement (2.2L)* or *Power Steering Pump Replacement (4.3L)*. Did you complete the repair?	Go to *Step 21*	—
16	Install the power steering gear correctly. Refer to *Power Steering Gear Replacement (RWD)* or *Power Steering Gear Replacement (4WD)*. Did you complete the repair?	Go to *Step 21*	—
17	Adjust the steering gear bearing preload. Refer to *Worm Thrust Bearing Preload Adjustment - Off Vehicle (700 Gear)*. Did you complete the repair?	Go to *Step 21*	—
18	Replace the worn steering linkage. Refer to *Steering Linkage Inspection* in Steering Linkage. Did you complete the repair?	Go to *Step 21*	—
19	Replace the worn suspension components. Refer to *Diagnostic Starting Point - Suspension General Diagnosis* in Suspension General Diagnosis. Did you complete the repair?	Go to *Step 21*	—
20	Replace the intermediate shaft. Refer to *Intermediate Steering Shaft Replacement - Upper* or *Intermediate Steering Shaft Replacement - Lower* in Steering Wheel and Column. Did you complete the repair?	Go to *Step 21*	—
21	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to *Step 3*

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Fig. 13: Rattle, Clunk, Or Shudder Noise From Power Steering System (2 Of 2) Courtesy of GENERAL MOTORS CORP.

WHINE OR GROWL NOISE FROM THE POWER STEERING SYSTEM

Step	Action	Yes	No
1	Did you review the Power Steering System Description and perform the necessary inspections?	Go to *Step 2*	Go to *Symptoms - Power Steering System*
2	Verify that a whine or growl noise is present. Is a whine or growl noise present?	Go to *Step 3*	System OK
3	Perform the power steering test procedure in order to diagnose a hydraulic condition and repair or replace a component. Refer to *Power Steering System Test Procedure*. Did you repair or replace a power steering system component?	Go to *Step 10*	Go to *Step 4*
4	Using the *J 39570* Chassis Ear, inspect the power steering gear for a whine or growl noise. Is the noise present at the power steering gear?	Go to *Step 7*	Go to *Step 5*
5	Using the *J 39570*, inspect the power steering pump for a whine or growl noise. Is the noise present at the power steering pump?	Go to *Step 8*	Go to *Step 6*
6	Using the *J 39570*, inspect the power steering hoses for a whine or growl noise. Is the noise present at the power steering hoses?	Go to *Step 9*	Go to *Step 2*
7	Replace the power steering gear. Refer to *Power Steering Gear Replacement (RWD)* or *Power Steering Gear Replacement (4WD)*. Did you complete the repair?	Go to *Step 10*	—
8	Replace the power steering pump. Refer to *Power Steering Pump Replacement (2.2L)* or *Power Steering Pump Replacement (4.3L)*. Did you complete the repair?	Go to *Step 10*	—
9	Adjust the routing of the power steering hoses. Did you complete the repair?	Go to *Step 10*	—
10	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to *Step 3*

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Fig. 14: Whine Or Growl Noise From Power Steering System Courtesy of GENERAL MOTORS CORP.

STEERING EFFORT HARD IN ONE OR BOTH DIRECTIONS

Step	Action	Yes	No
1	Did you review the Power Steering System General Description and perform the necessary inspections?	Go to *Step 2*	Go to *Symptoms - Power Steering System*
2	Verify that the steering effort is hard in one or both directions. Does the system operate normally?	System OK	Go to *Step 3*
3	Perform the power steering test procedure. Refer to *Power Steering System Test Procedure*. Did you complete the procedure?	Go to *Step 4*	—
4	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to *Step 3*

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Fig. 15: Steering Effort Hard In One Or Both Directions Courtesy of GENERAL MOTORS CORP.

STEERING EFFORT TOO EASY IN ONE OR BOTH DIRECTIONS

Step	Action	Yes	No
1	Did you review the Power Steering System Description and perform the necessary inspections?	Go to *Step 2*	Go to *Symptoms - Power Steering System*
2	Verify that the steering effort is too easy in one or both directions. Does the system operate normally?	System OK	Go to *Step 3*
3	Perform the power steering test procedure. Refer to *Power Steering System Test Procedure*. Did you complete the procedure?	Go to *Step 4*	—
4	Operate the system in order to verify the repair. Did you correct the condition?	System OK	Go to *Step 3*

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Fig. 16: Steering Effort Too Easy In One Or Both Directions
Courtesy of GENERAL MOTORS CORP.

REPAIR INSTRUCTIONS

BLEEDING THE POWER STEERING SYSTEM

Tools Required

- *J 35555* Metal Mityvac
- *J 43485* Power Steering Bleeder Adapter

Important: Hoses touching the frame, body, or engine may cause system noise.

1. Verify that the hoses do not touch any other part of the vehicle.

   Important: Loose connections may not leak, but could allow air into the steering system.

2. Verify that all hose connections are tight.

   NOTE: If the power steering system has been serviced, an accurate fluid level reading cannot be obtained unless air is bled from the steering system. The air in the fluid may cause pump cavitation noise and may cause pump damage over a period of time.

   Important: Maintain the fluid level throughout the bleed procedure.

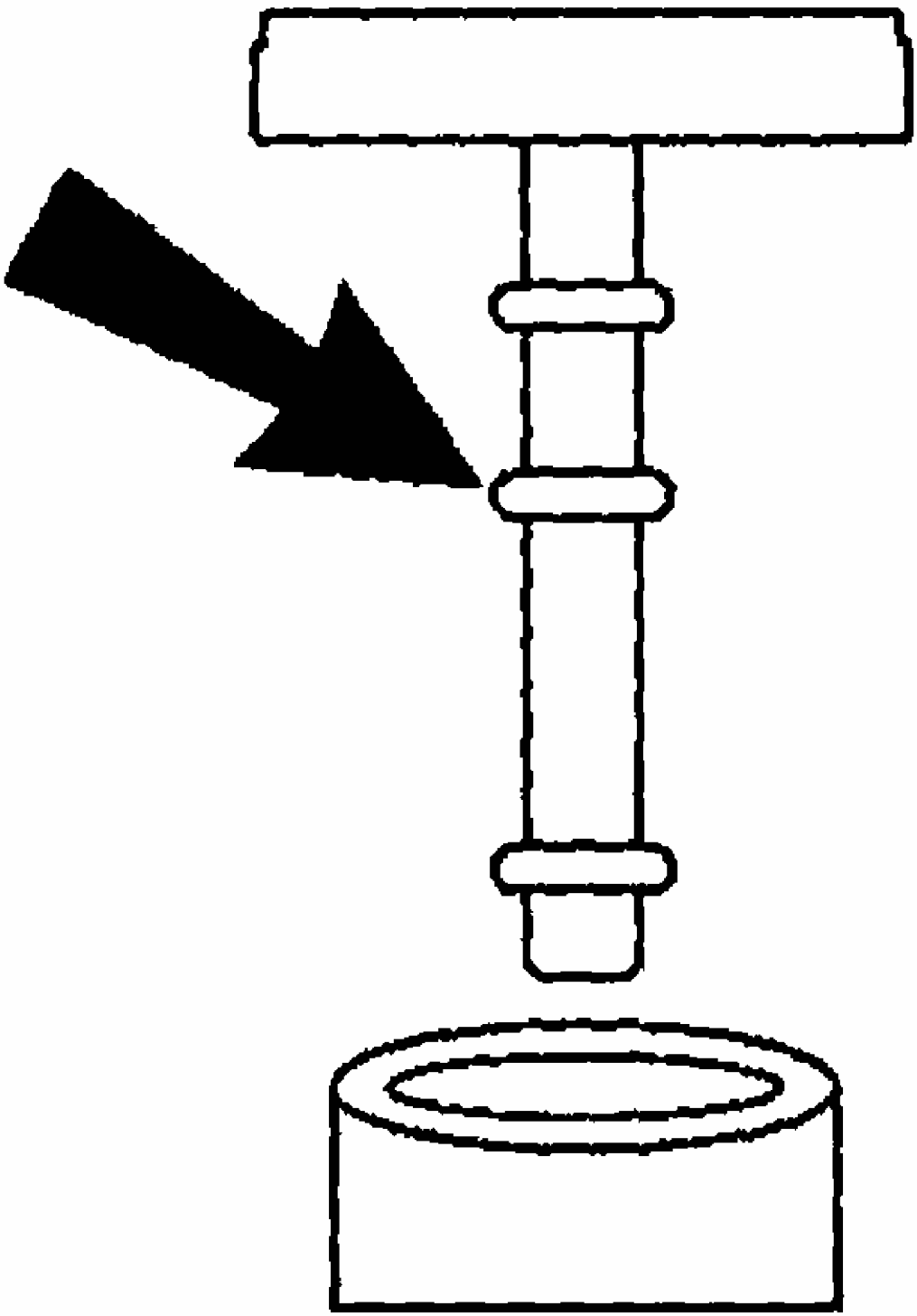

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Fig. 17: Identifying Pump Reservoir Cap

Courtesy of GENERAL MOTORS CORP.

3. Remove the pump reservoir cap.

   Important: Use clean, new power steering fluid only.

4. Fill the pump reservoir with fluid to the FULL COLD level.
5. Attach the *J 43485* to the *J 35555* or equivalent.
6. Place the *J 43485* on or in the pump reservoir filler neck.
7. Apply a vacuum of 68 kPa (20 in Hg) maximum.
8. Wait 5 minutes.

   Typical vacuum drop is 7-10 kPa (2-3 in Hg). If the vacuum does not remain steady, refer to Excessive Vacuum Drop Diagnosis at the end of this procedure.

9. Remove the *J 43485* and the *J 35555* .
10. Reinstall the pump reservoir cap.
11. Start the engine. Allow the engine to idle.
12. Turn off the engine.
13. Verify the fluid level. Repeat steps 11-13 until the fluid stabilizes.

    Important: Do not turn steering wheel to lock.

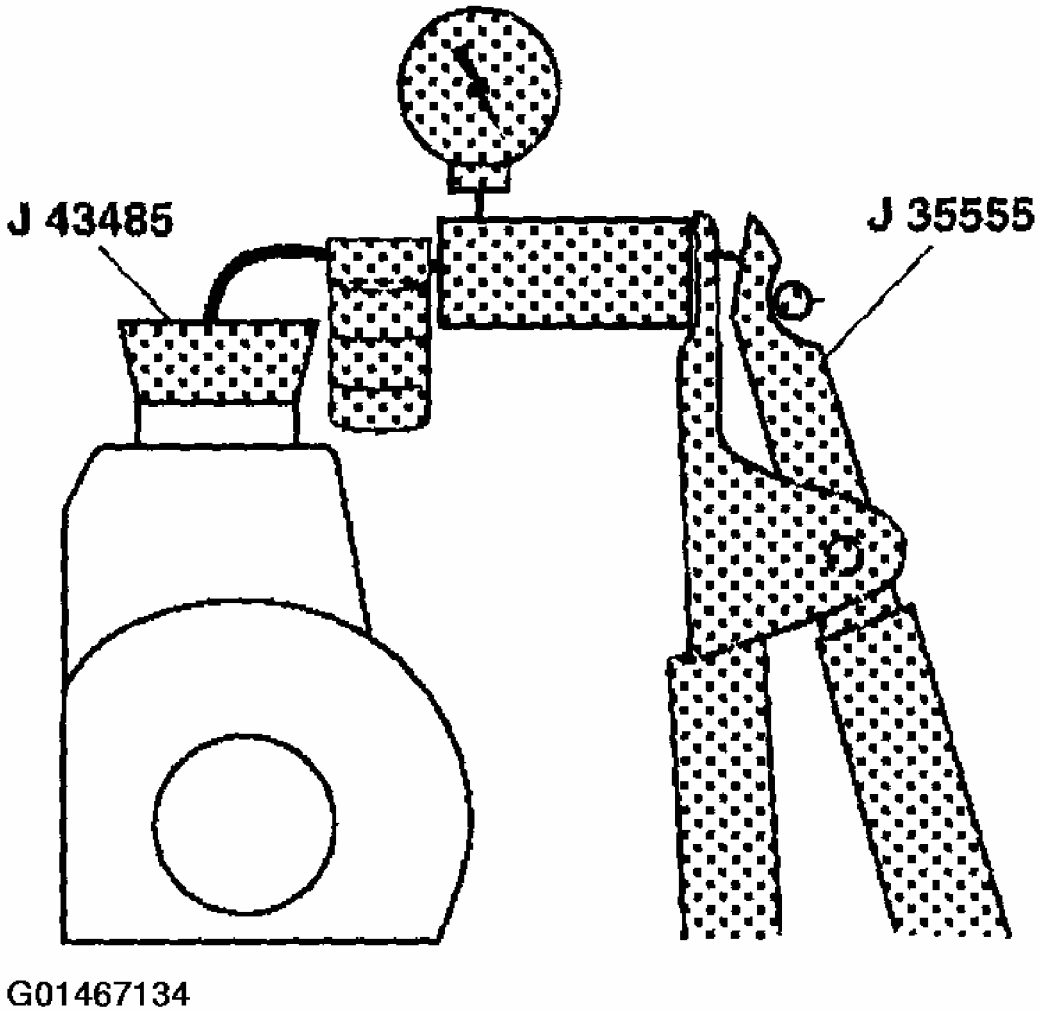

Fig. 18: Identifying Metal Mityvac & Power Steering Bleeder Adapter (SST)
Courtesy of GENERAL MOTORS CORP.

14. Start the engine. Allow the engine to idle.
15. Turn the steering wheel 180-360 degrees in both directions 5 times.
16. Switch the ignition off.

NOTE: When adding fluid or making a complete fluid change, always use the proper power steering fluid. Failure to use the proper fluid will cause hose and seal damage and fluid leaks.

17. Verify the fluid level.
18. Remove the pump reservoir cap.

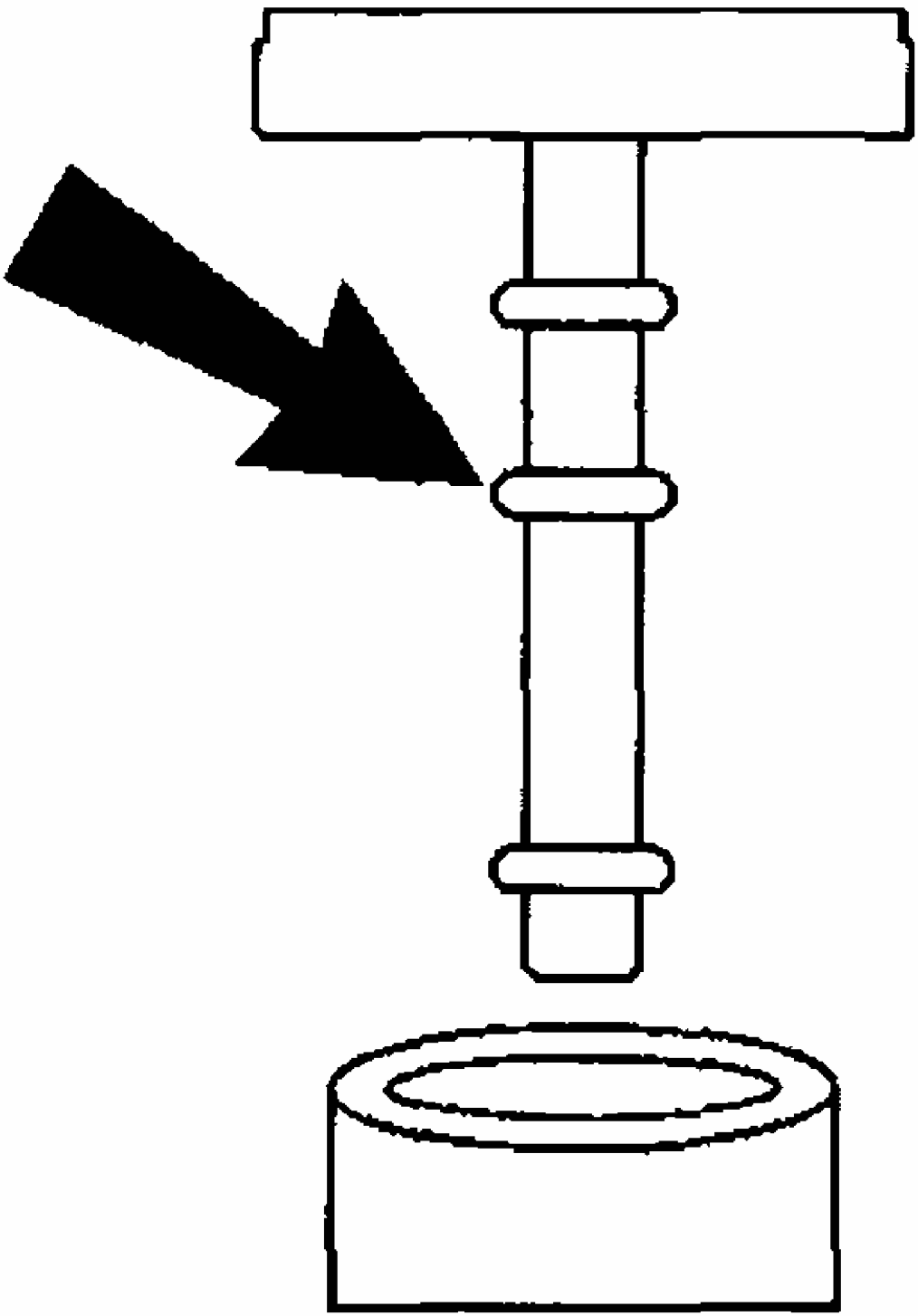

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Fig. 19: Pump Reservoir Cap

Courtesy of GENERAL MOTORS CORP.

19. Attach the *J 43485* to the *J 35555* or equivalent.
20. Place the *J 43485* on or in the pump reservoir filler neck.
21. Apply a vacuum of 68 kPa (20 in Hg) maximum.
22. Wait 5 minutes.
23. Remove the *J 43485* and the *J 35555* .
24. Verify the fluid level.

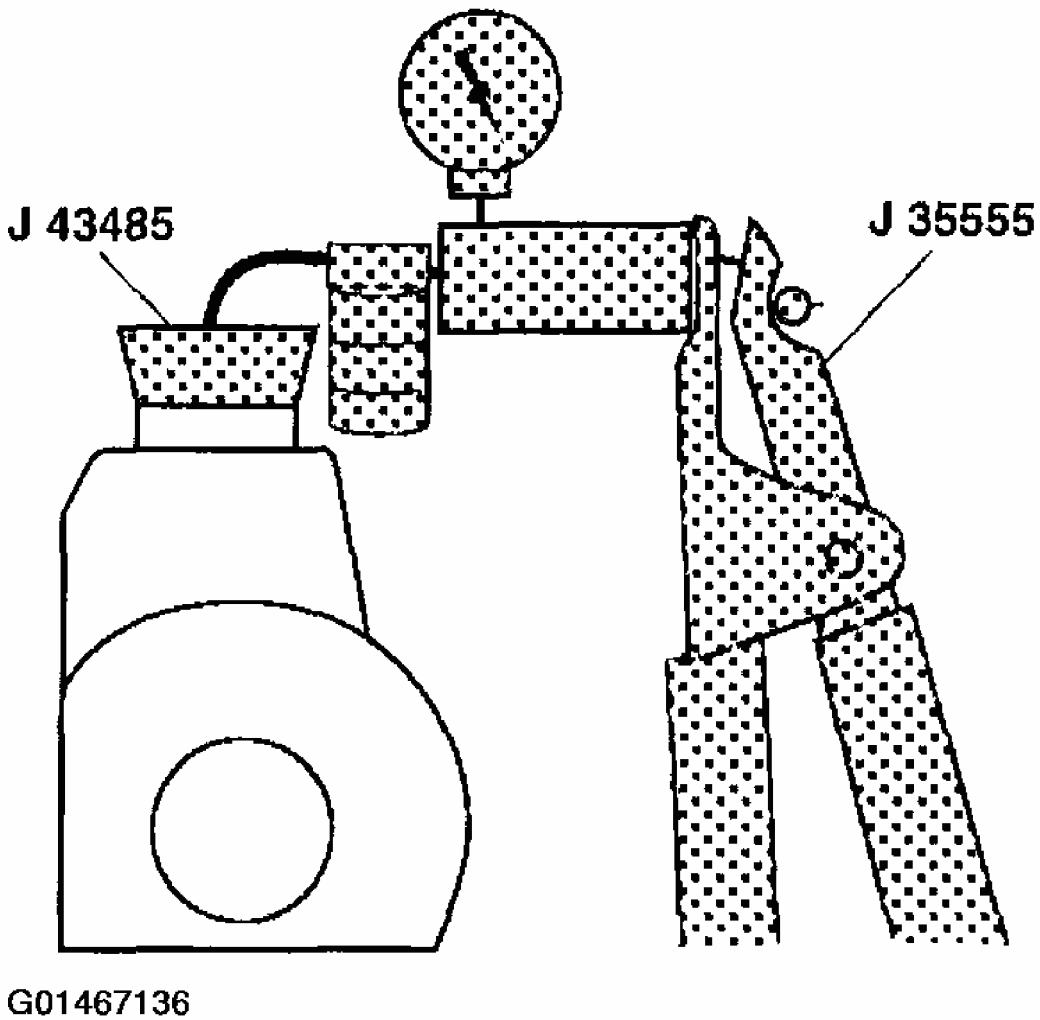

Fig. 20: Attaching Metal Mityvac & Power Steering Bleeder Adapter (SST)
Courtesy of GENERAL MOTORS CORP.

25. Reinstall the pump reservoir cap.

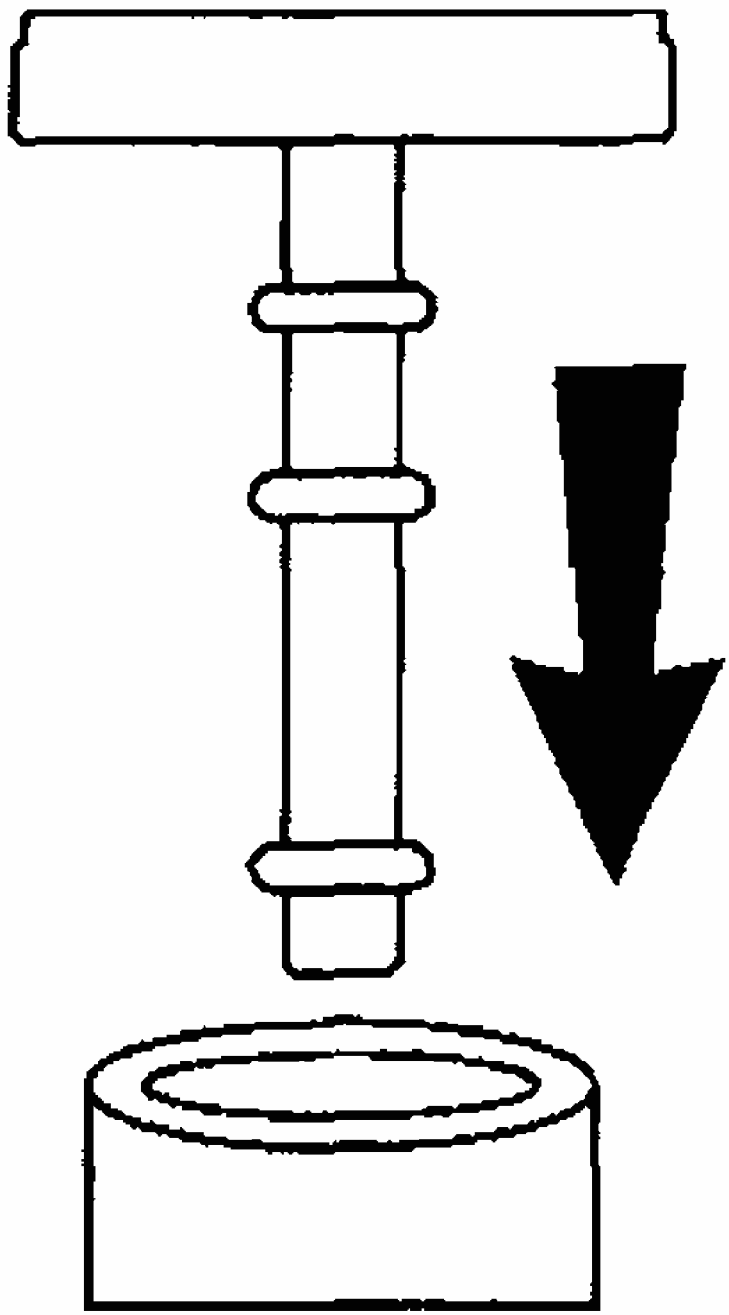

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Fig. 21: Reinstalling Pump Reservoir Cap
Courtesy of GENERAL MOTORS CORP.

Excessive Vacuum Drop Diagnosis

1. If the vacuum continues to drop, remove the pressure and return hose from the pump.
2. Install the plugs (1,2) supplied with the *J 43485* into the pressure and return port.

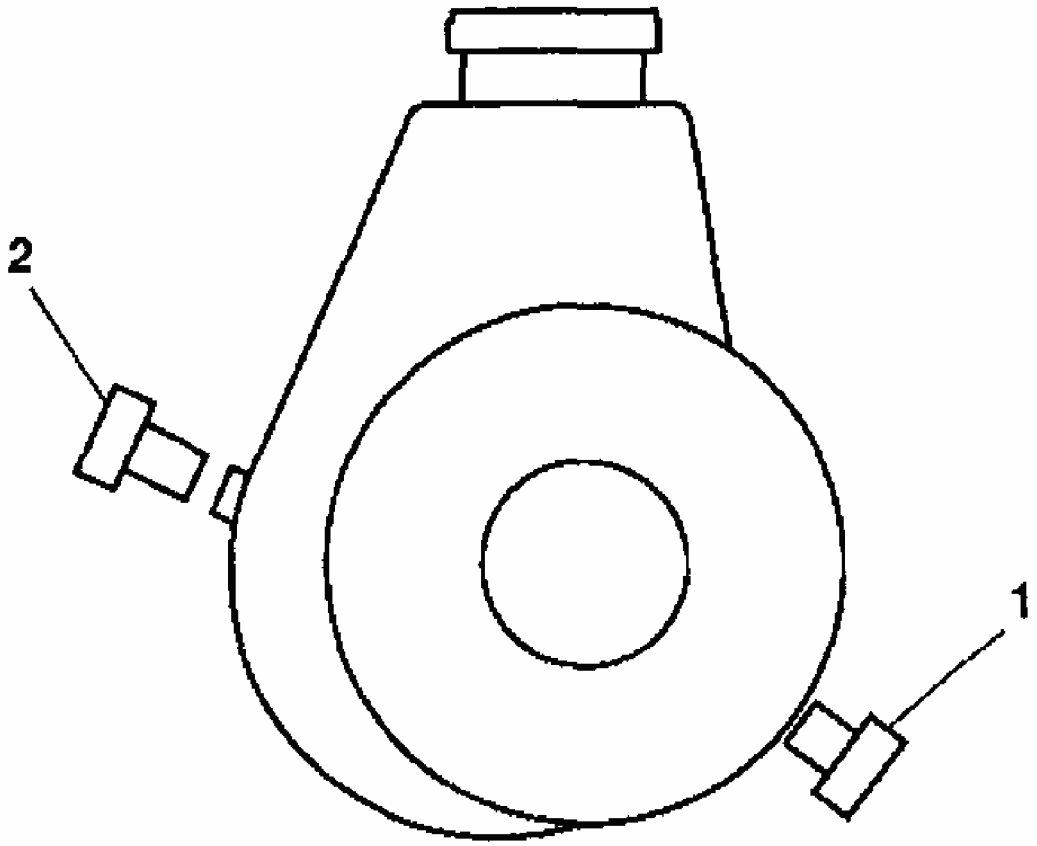

Fig. 22: Identifying Plugs
Courtesy of GENERAL MOTORS CORP.

3. Attach the *J 43485* to the *J 35555* or equivalent.
4. Place the *J 43485* on or in the pump reservoir filler neck.
5. Apply a vacuum of 68 kPa (20 in Hg) maximum.
6. If the vacuum drops again, repair or replace the pump. If the vacuum holds steady, continue to check the other parts of the steering system.

Important: Fluid must be free from bubbles and foam. Be aware of periodic bubbles that indicate a loose connection or leaking O-ring seal in the return hose or the pressure hose.

Fluid must be free from discoloration.

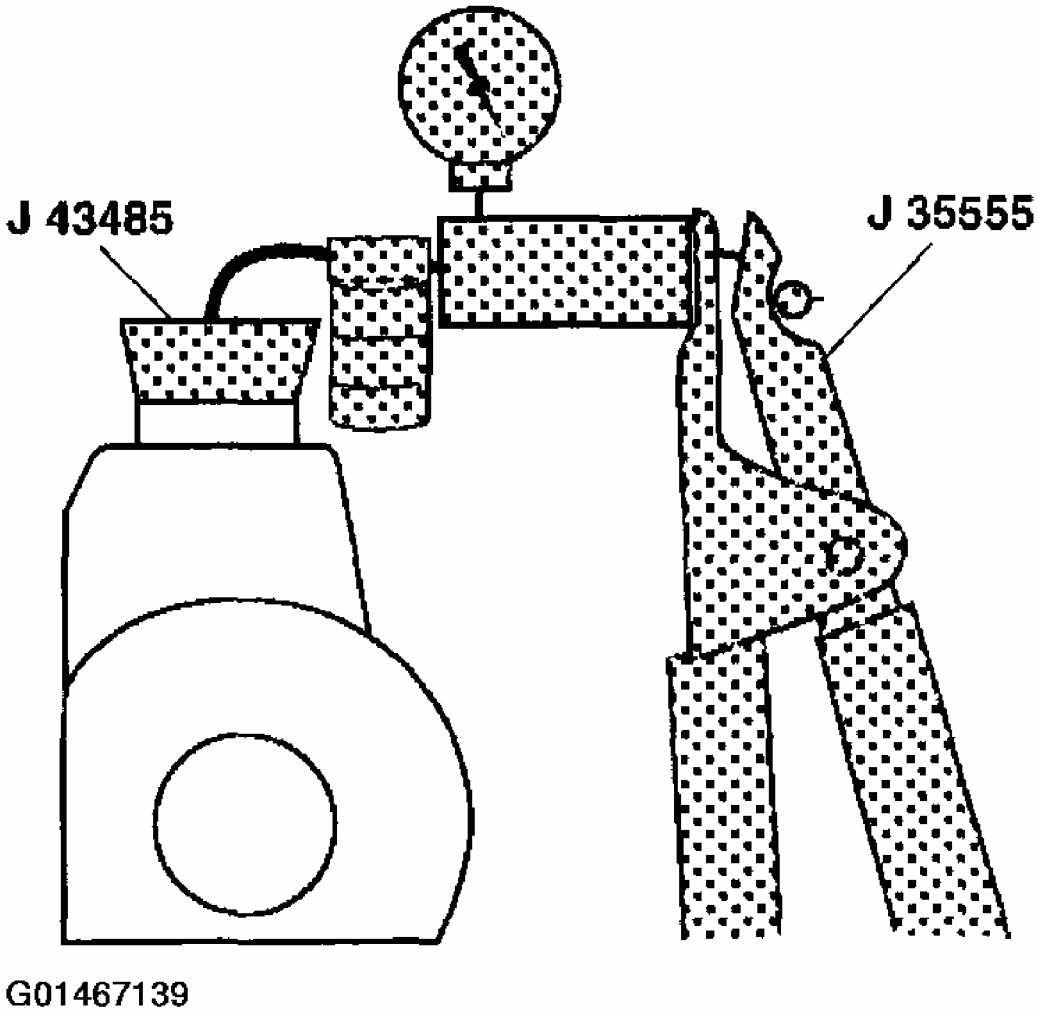

Fig. 23: Placing Power Steering Bleeder Adapter On Or In Pump Reservoir Filler Neck
Courtesy of GENERAL MOTORS CORP.

7. Observe the fluid.
8. If condition persists, replace the following parts:
    - The return hose clamps
    - The return hose O-rings
    - The pressure hose O-rings
    - The gear cylinder line O-rings
    - The reservoir to pump O-ring
9. Repeat the bleed procedure from the beginning.
10. Drive the vehicle approximately 16 km (10 mi) in order to warm the system to

operating temperature. Evaluate vehicle on a smooth flat surface.

11. Verify the following conditions:
    - There is smooth power assist.
    - The vehicle operates quietly.
    - The pump maintains the proper fluid level.
    - There is not any leaking in the steering system.
    - The fluid is free of foam or discoloration.

CHECKING & ADDING POWER STEERING FLUID

NOTE: When adding fluid or making a complete fluid change, always use the proper power steering fluid. Failure to use the proper fluid will cause hose and seal damage and fluid leaks.

1. Clean the area surrounding the reservoir cap.
2. Remove the reservoir cap.
3. Inspect the power steering pump fluid level at regular intervals. Use the appropriate procedure below.

   Add fluid when required. Refer to FLUID AND LUBRICANT RECOMMENDATIONS in Maintenance and Lubrication.

   Fluid Is Cold

   3.1. Remove the reservoir cap.

   3.2. Inspect the fluid level on the capstick.

   3.3. Ensure that the fluid level is between the bottom of the COLD/FULL mark and the end of the capstick.

   Fluid Is Hot

   1. 3.1. Run the engine until the fluid reaches about 80°C (170°F).
   2. 3.2. Turn the engine OFF.
   3. 3.3. Remove the reservoir cap.
   4. 3.4. Inspect the fluid level on the capstick.
   5. 3.5. Ensure that the fluid level is between the HOT/FULL and the COLD/FULL marks on the capstick.
4. If the fluid level is low, add power steering fluid to the proper level.
5. Install the reservoir cap.
6. When checking the fluid level after servicing the steering system, bleed the air from the

system. Refer to **BLEEDING THE POWER STEERING SYSTEM** .

FLUSHING POWER STEERING SYSTEM

Important: Do not reuse any drained power steering fluid regardless of appearance or condition.

1. Turn off the engine.
2. Raise the front end of the vehicle off the ground until the tires and wheels turn freely. Refer to **LIFTING AND JACKING THE VEHICLE** in General Information.
3. Place a large container under the fluid return hose in order to collect the draining fluid.
4. Remove the fluid return hose at the power steering pump reservoir inlet connection.
5. Plug the reservoir return hose inlet connection on the power steering pump.

   Important:

   - This step may require 4 L (4 qt) of power steering fluid until the draining fluid appears clear.
   - Do not run the engine without the power steering fluid level at FULL COLD.
6. Run the engine at idle while an assistant maintains the fluid level at FULL COLD in the reservoir using new approved power steering fluid.
7. Turn off the engine.
8. Turn the steering wheel fully to the left and to the right.
9. Remove the plug from the pump reservoir inlet connection.
10. Install the fluid return hose to the pump reservoir.
11. Maintain the fluid level at FULL COLD.
12. Operate the engine at idle for approximately 15 minutes.
13. Repeat steps 3-5.
14. Inspect the power steering fluid for the following indications of contamination:
    - Milky fluid - water
    - Brown fluid - burnt
    - Plastic debris or dirt chunks
15. If the fluid is contaminated, repeat steps 6-12 in order to complete a third flush.
16. Remove the plug from the pump reservoir inlet connection.
17. Install the fluid return hose to the pump reservoir.
18. Clean any spilled fluid.
19. Bleed the power steering system. Refer to **BLEEDING THE POWER STEERING SYSTEM**

POWER STEERING PULLEY REPLACEMENT

Tools Required

- *J 25034-C* Power Steering Pump Pulley Remover
- *J 25033-C* Power Steering Pump Pulley Installer

Removal Procedure

1. Remove the fan clutch. Refer to **FAN CLUTCH REPLACEMENT** in Engine Cooling.
2. Remove the drive belt. Refer to **DRIVE BELT REPLACEMENT** in Engine Mechanical 2.2L or **DRIVE BELT REPLACEMENT** in Engine Mechanical 4.3L.
3. Remove the power steering pump pulley using *J 25034-C* .

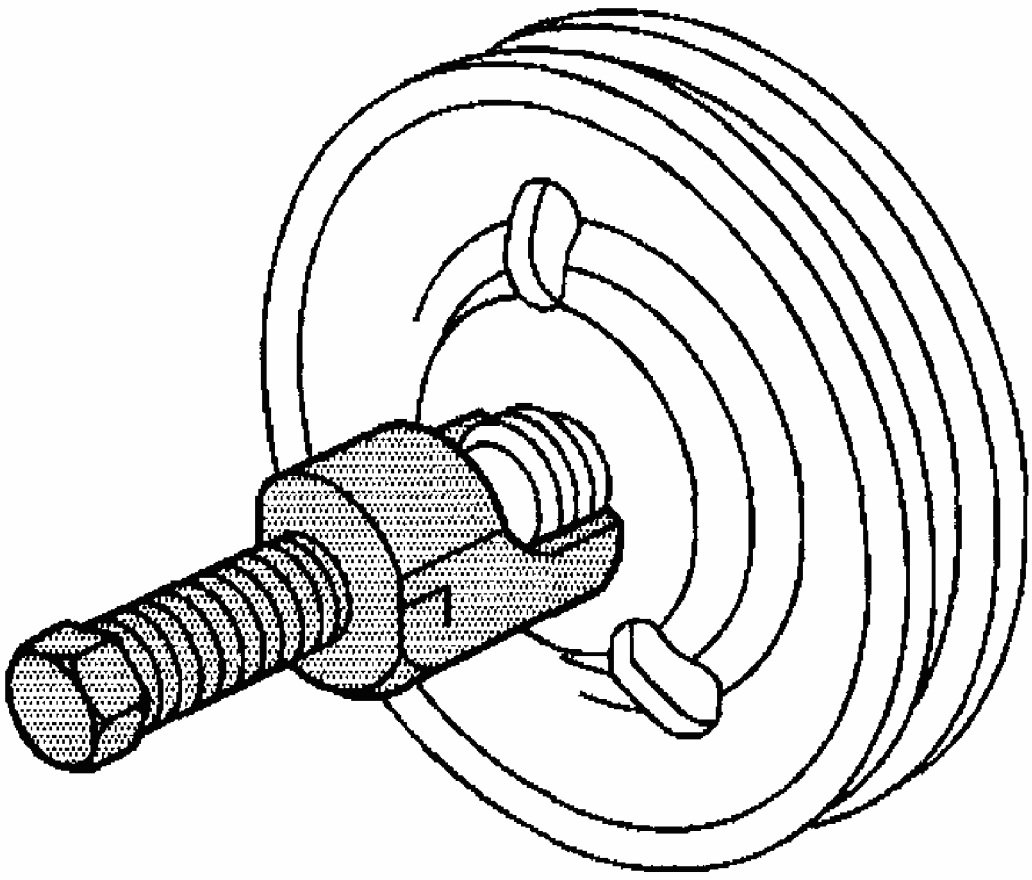

Fig. 24: Identifying Power Steering Pump Pulley Remover For Removing Pump Pulley (SST)
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

1. Place the power steering pump pulley on the end of the power steering pump shaft.
2. Install the power steering pump pulley using *J 25033-C* .

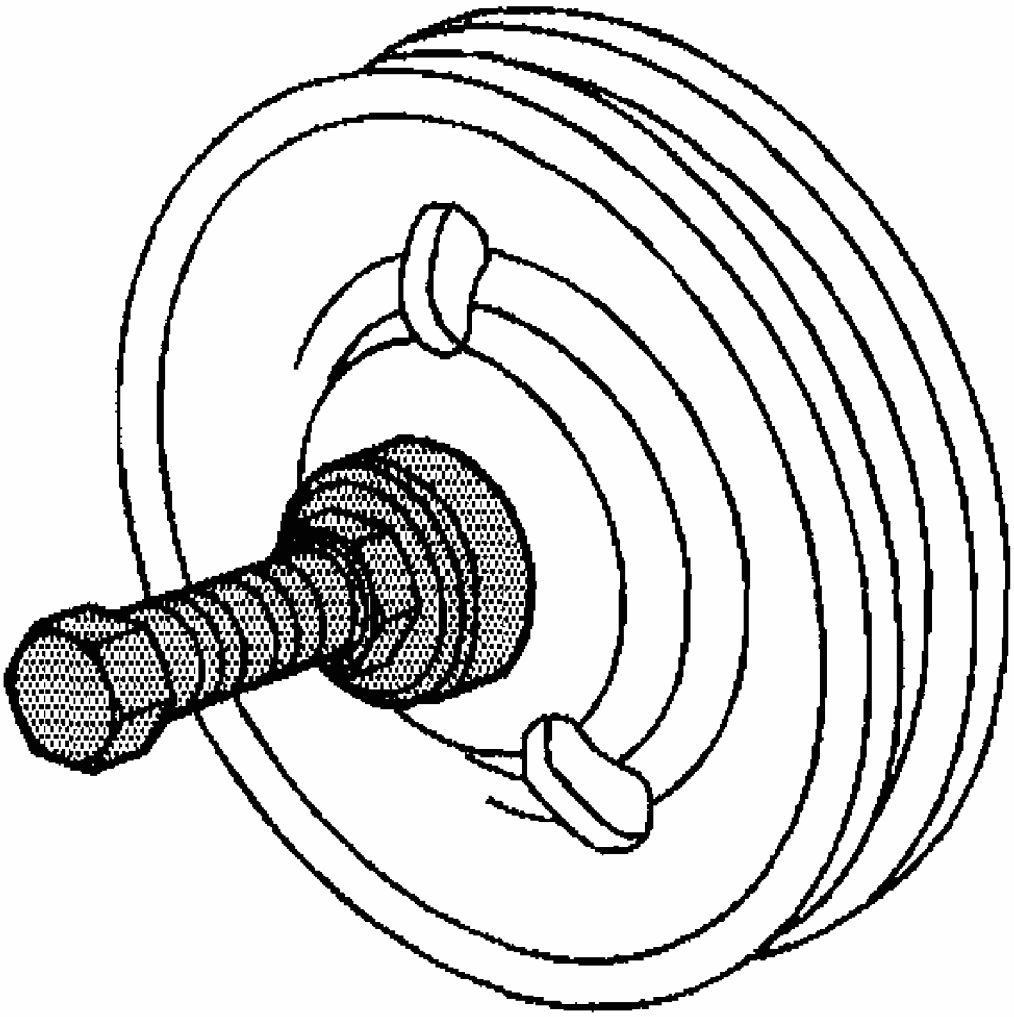

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Fig. 25: Identifying Power Steering Pump Pulley Installer For Installing Pump Pulley (SST)
Courtesy of GENERAL MOTORS CORP.

3. Ensure that the power steering pump pulley (1) is flush against the power steering pump shaft (2), with an allowable variance of 0.25 mm (0.010 in).
4. Install the drive belt. Refer to **DRIVE BELT REPLACEMENT** in Engine

Mechanical 2.2L or **DRIVE BELT REPLACEMENT** in Engine Mechanical 4.3L.

5. Install the fan clutch. Refer to **FAN CLUTCH REPLACEMENT** in Engine Cooling.

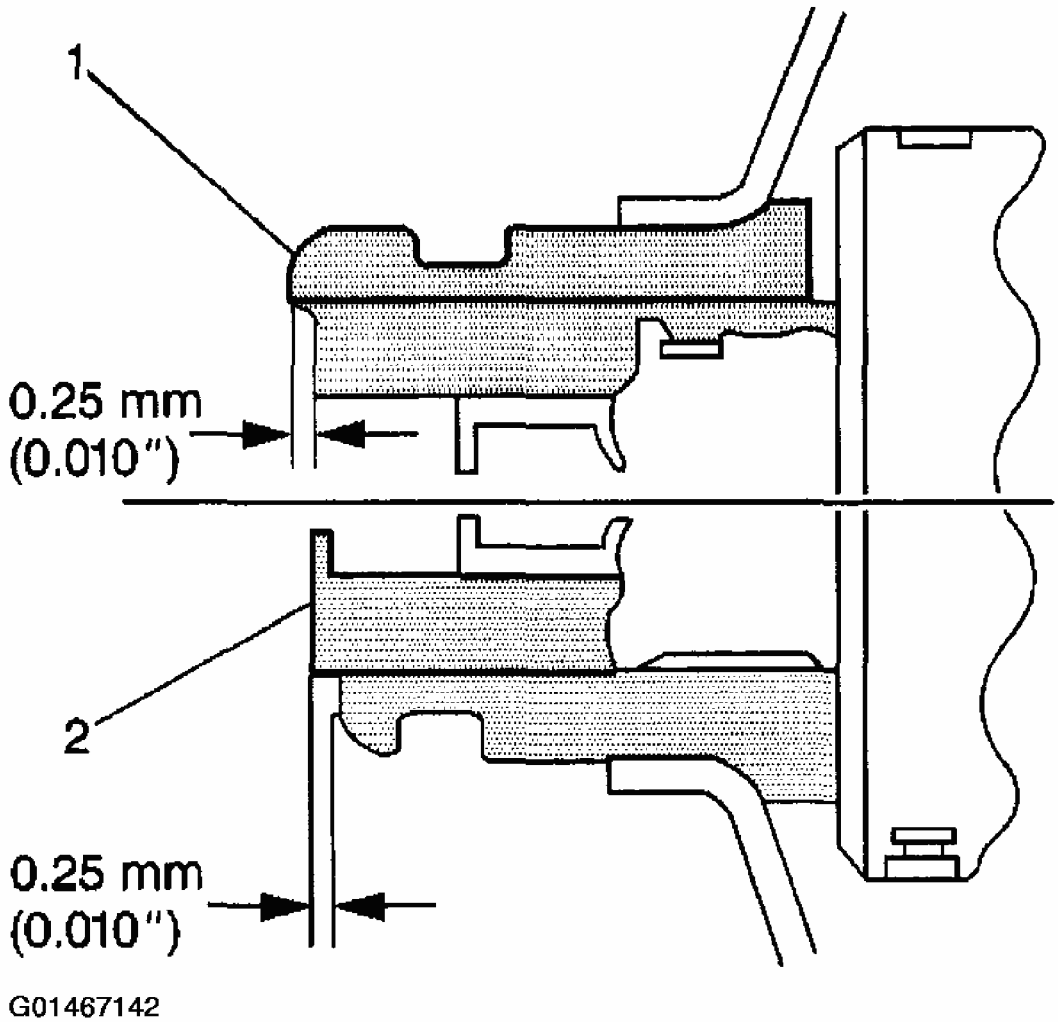

Fig. 26: Checking Power Steering Pump Pulley Attachment Against Power Steering Pump Shaft With Specific Gap
Courtesy of GENERAL MOTORS CORP.

POWER STEERING PUMP REPLACEMENT (2.2L)

Removal Procedure

1. Remove the upper fan shroud. Refer to **FAN SHROUD REPLACEMENT** in Engine Cooling.
2. Place a drain pan below the pump.
3. Remove the power steering hoses from the pump.

4. Cap the power steering hoses.
5. Remove the drive belt. Refer to **DRIVE BELT REPLACEMENT** in Engine Mechanical 2.2L.
6. Remove the power steering pump pulley. Refer to **POWER STEERING PULLEY REPLACEMENT** .

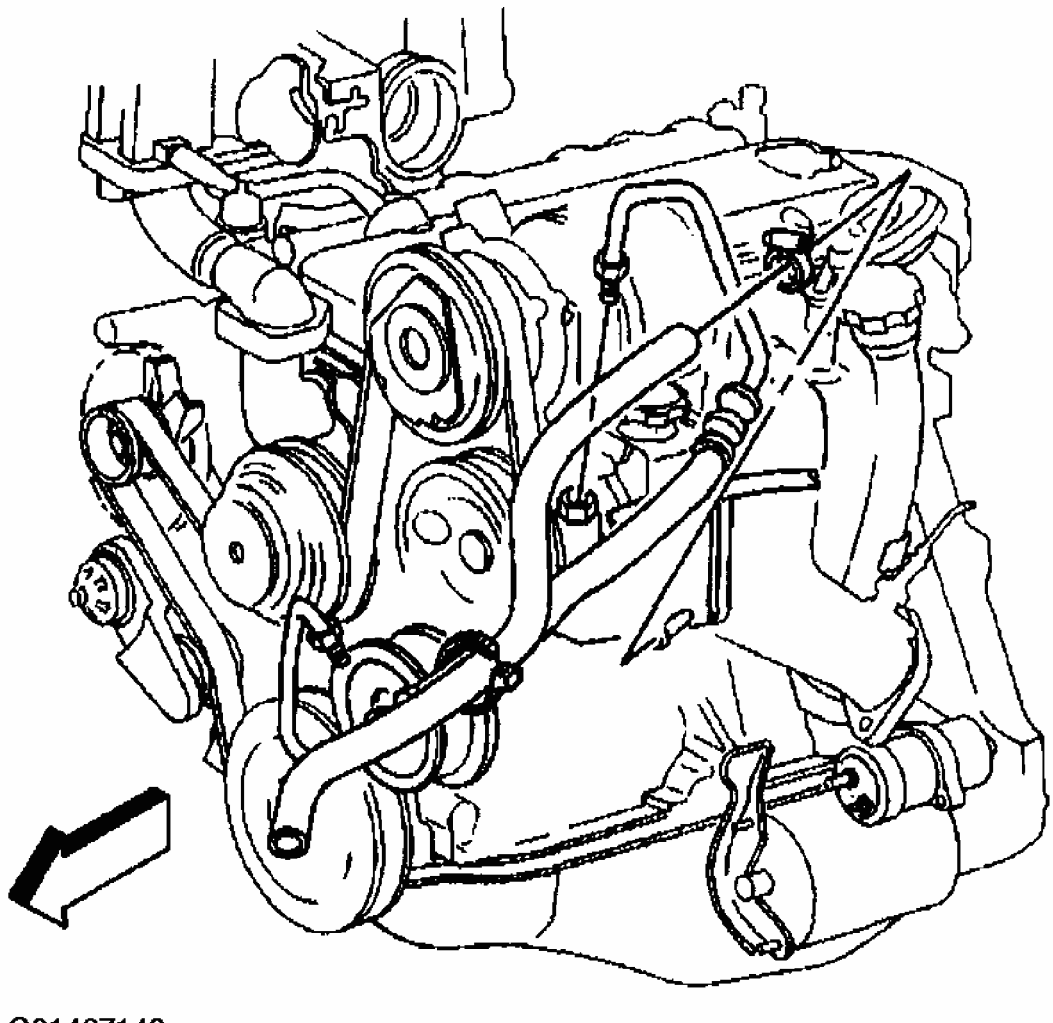

Fig. 27: Removing Power Steering Hoses From Pump
Courtesy of GENERAL MOTORS CORP.

7. Disconnect the A/C compressor electrical connection.

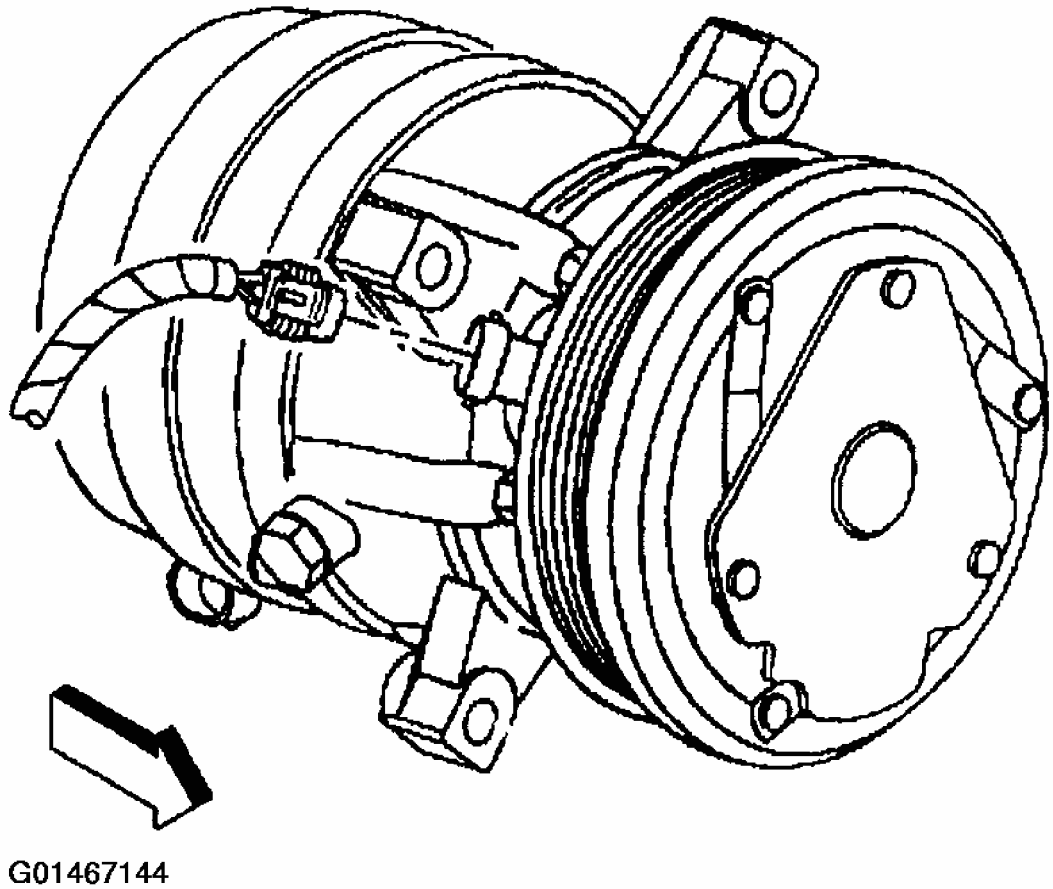

Fig. 28: Disconnecting A/C Compressor Electrical Connection
Courtesy of GENERAL MOTORS CORP.

8. Remove the A/C compressor mounting bolts.
9. Remove the A/C compressor rear bracket mounting bolts.
10. Remove the A/C compressor from the brackets and set aside.

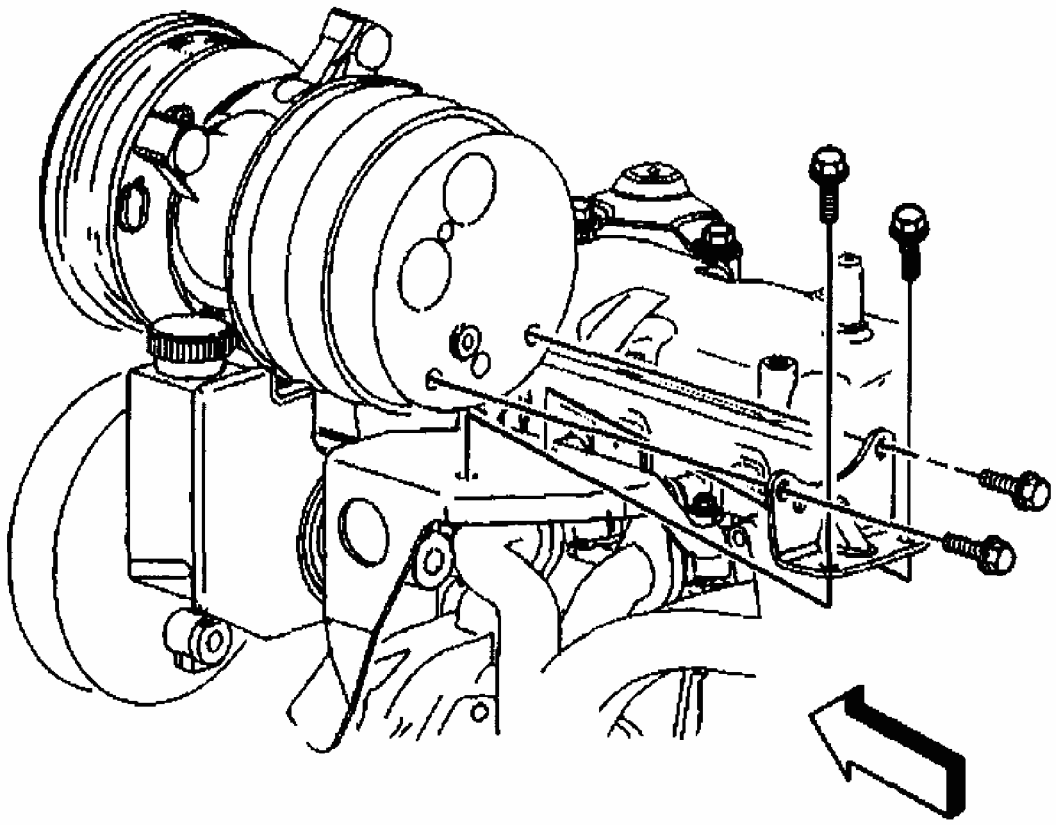

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Fig. 29: A/C Compressor Rear Bracket Mounting Bolts
Courtesy of GENERAL MOTORS CORP.

11. Remove the power steering pump front mounting bolts.
12. Remove the power steering pump rear mounting bracket nuts from the engine studs.
13. Remove the power steering pump rear mounting bracket bolt.
14. Remove the power steering pump.

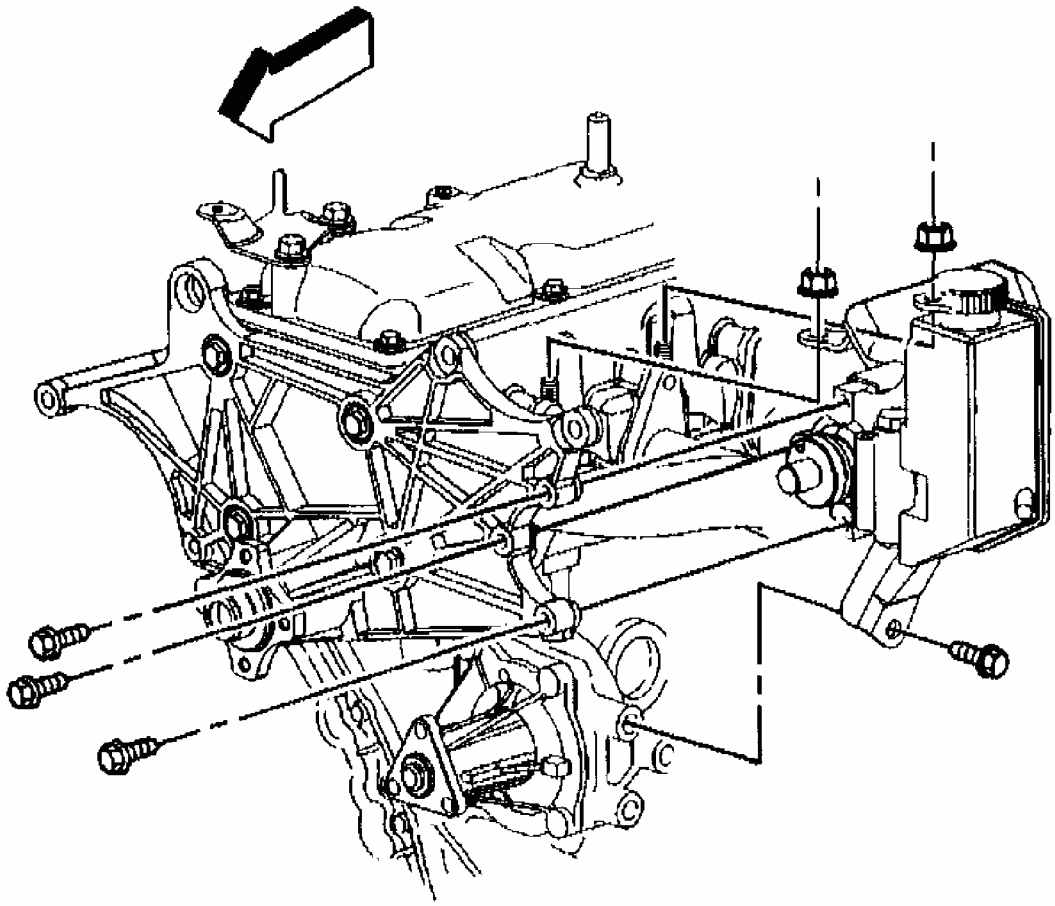

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Fig. 30: Removing Power Steering Pump Rear Mounting Bracket Nuts From Engine Studs
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

1. Install the power steering pump.

   NOTE: Refer to FASTENER NOTICE in Cautions and Notices.

2. Install the power steering pump front mounting bolts.

   Tighten

   Tighten the power steering pump front mounting bolts to 30 N.m (22 lb ft).

3. Install the power steering pump rear mounting bracket bolt.

4. Install the power steering pump rear mounting bracket nuts to the engine studs.

   Tighten

   Tighten the power steering pump rear mounting bracket bolt and nuts to 50 N.m (37 lb ft).

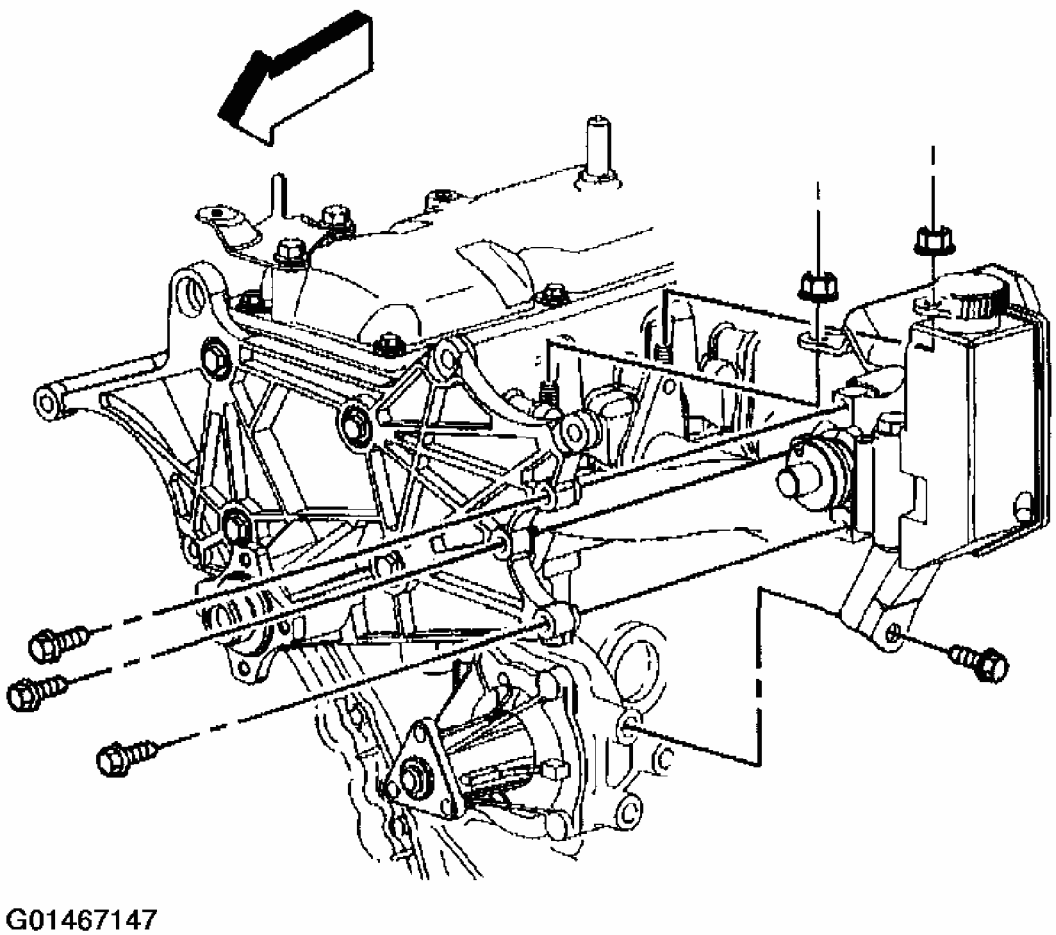

Fig. 31: Power Steering Pump Rear Mounting Bracket Bolts & Nuts
Courtesy of GENERAL MOTORS CORP.

5. Install the A/C compressor to the accessory bracket.
6. Install the A/C compressor rear bracket mounting bolts.

   Tighten

   Tighten the A/C compressor rear bracket mounting bolts to 31 N.m (23 lb ft).

7. Install the A/C compressor mounting bolts.

Tighten

Tighten the A/C compressor mounting bolts to 50 N.m (37 lb ft).

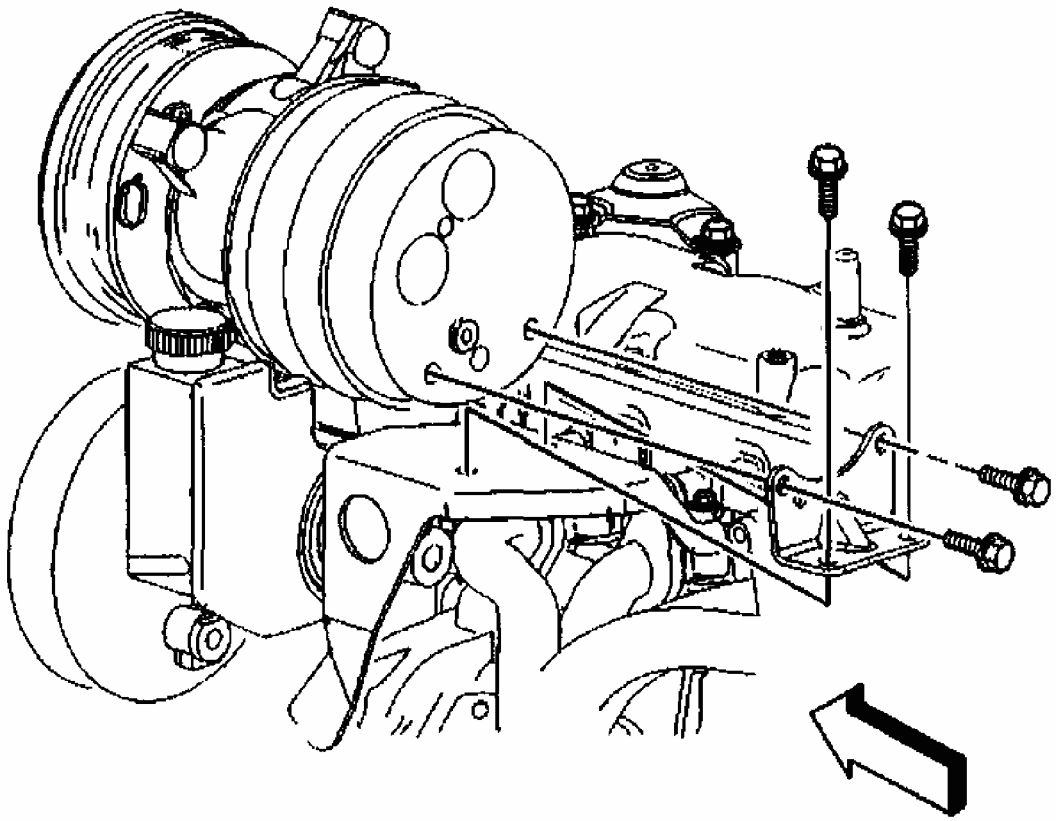

Fig. 32: A/C Compressor Rear Bracket Mounting Bolts
Courtesy of GENERAL MOTORS CORP.

8. Connect the A/C compressor electrical connection.
9. Install the power steering pump pulley. Refer to **POWER STEERING PULLEY REPLACEMENT** .
10. Install the drive belt. Refer to **DRIVE BELT REPLACEMENT** in Engine Mechanical 2.2L.

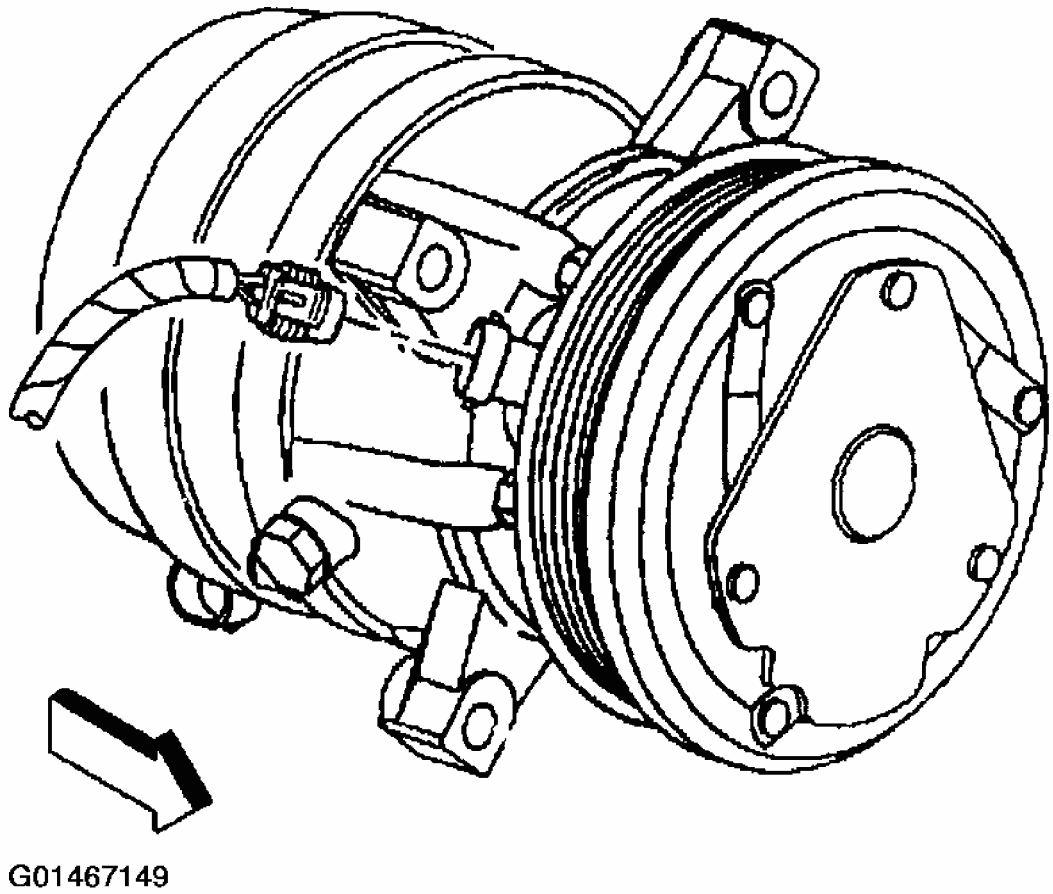

Fig. 33: Connecting A/C Compressor Electrical Connection
Courtesy of GENERAL MOTORS CORP.

11. Install the power steering pump hoses.
12. Install the upper fan shroud. Refer to **FAN SHROUD REPLACEMENT** in Engine Cooling.
13. Fill the power steering system.
14. Bleed the system. Refer to **BLEEDING THE POWER STEERING SYSTEM** .
15. Inspect the hoses for clearance away from the frame and other components.

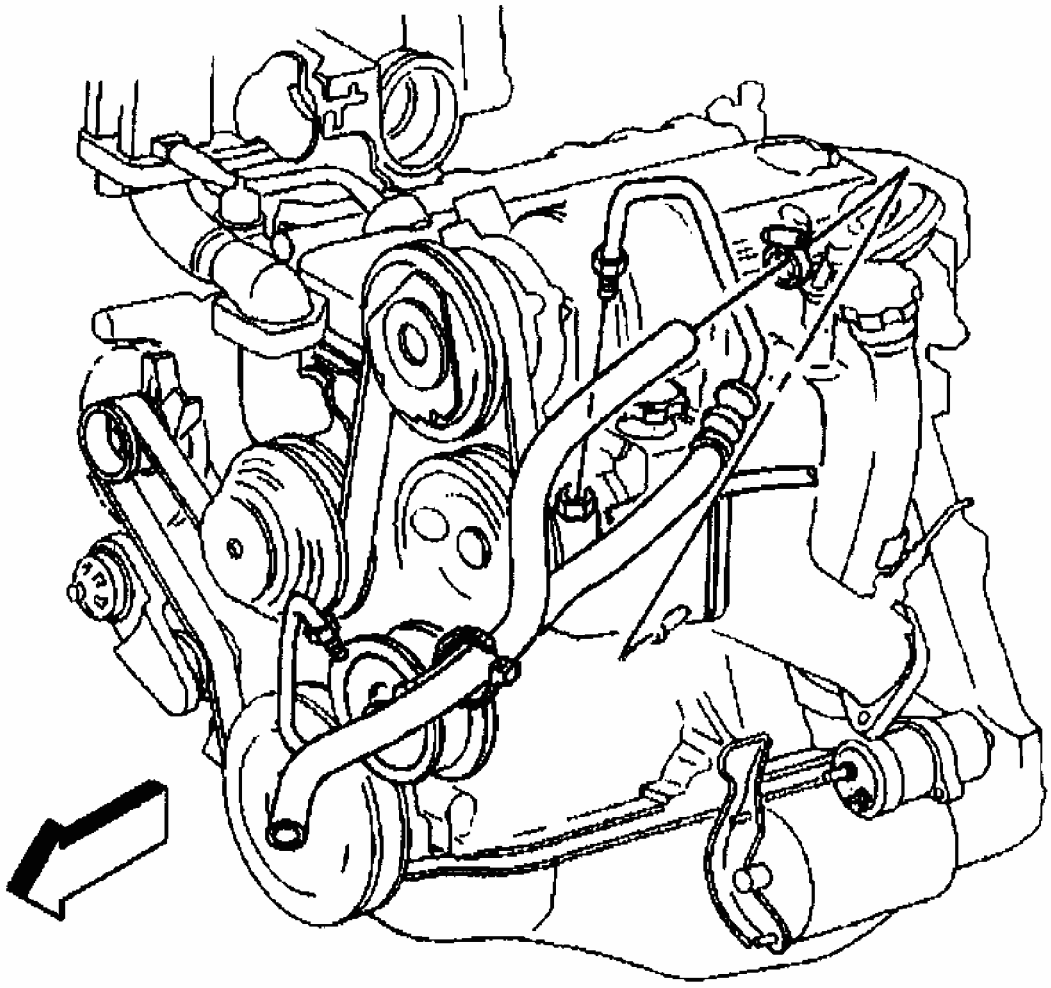

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Fig. 34: Power Steering Pump Hoses
Courtesy of GENERAL MOTORS CORP.

POWER STEERING PUMP REPLACEMENT (4.3L)

Removal Procedure

1. Place a drain pan under the vehicle.
2. Remove the air cleaner assembly. Refer to AIR CLEANER ASSEMBLY REPLACEMENT in Engine Controls 4.3L.
3. Remove the power steering pump pulley. Refer to **POWER STEERING PULLEY REPLACEMENT** .
4. Disconnect the power steering pressure hose from the power steering gear.

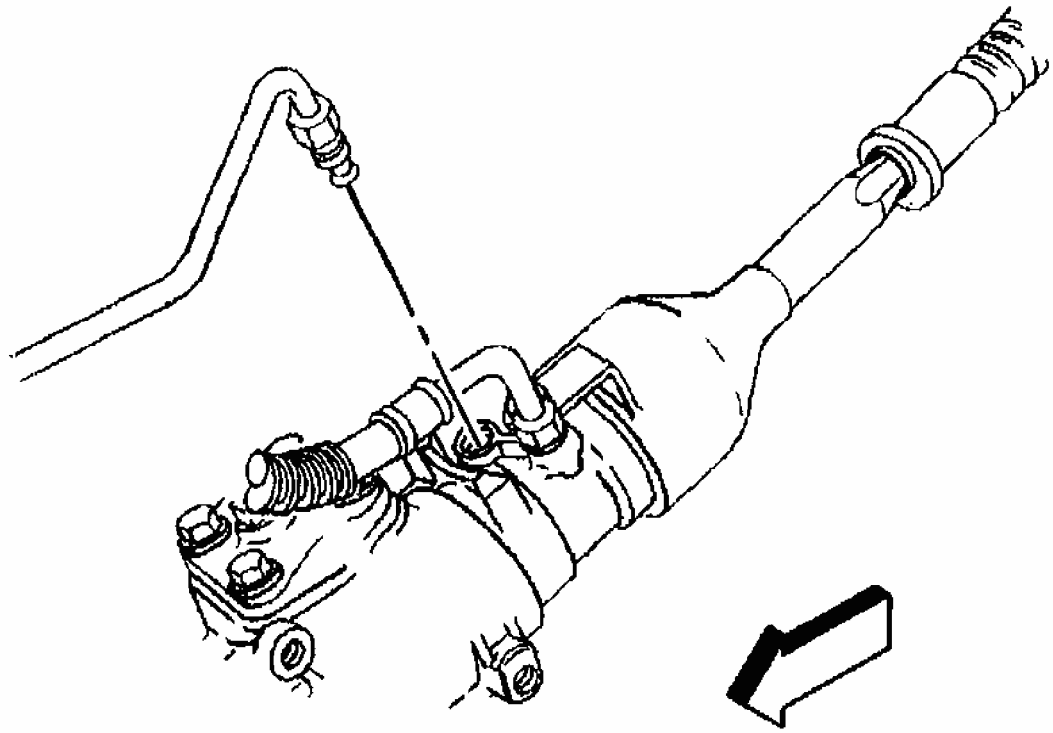

Fig. 35: Disconnecting Power Steering Pressure Hose From Power Steering Gear
Courtesy of GENERAL MOTORS CORP.

5. Disconnect the power steering cooler hose from the power steering pump.

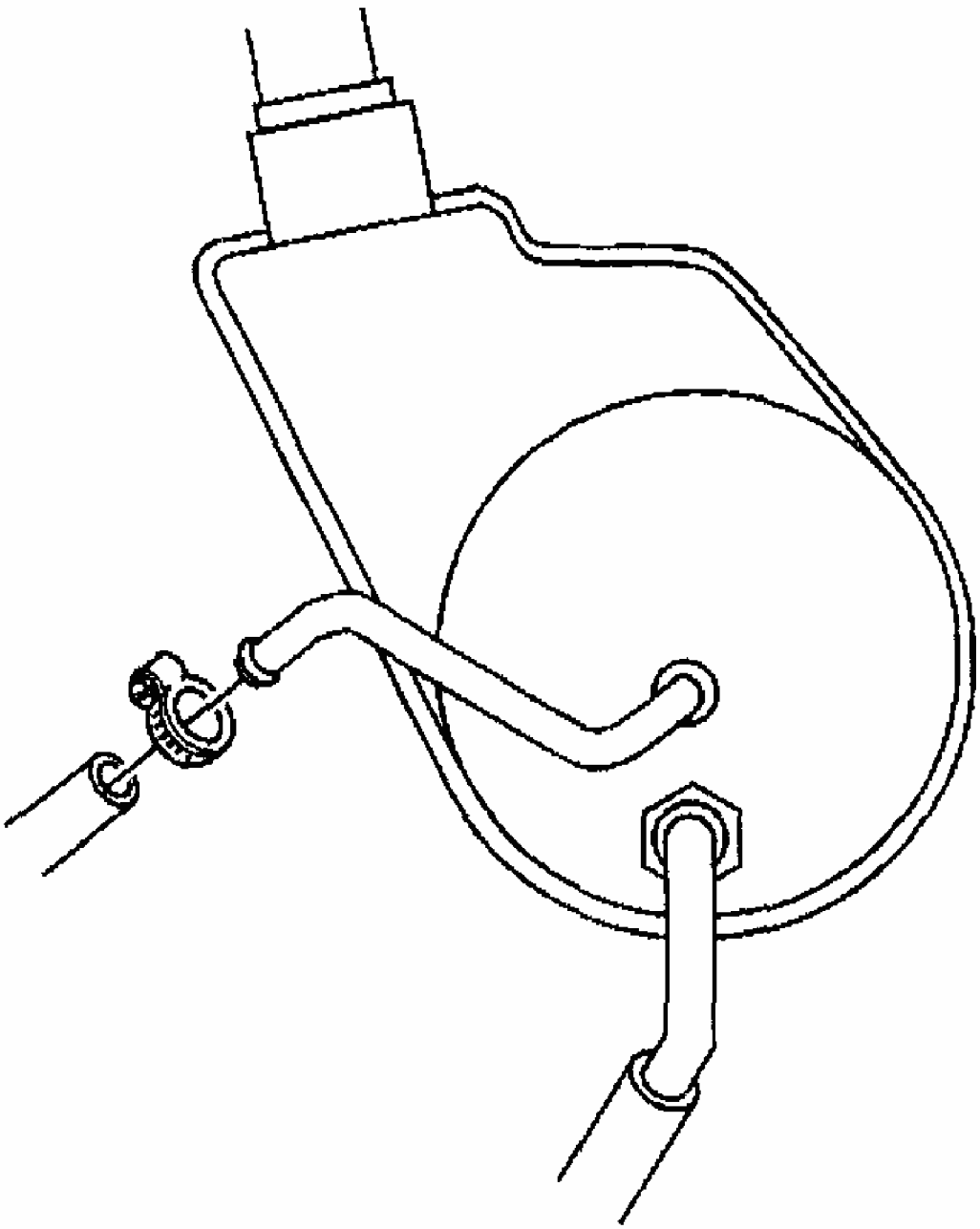

Fig. 36: Disconnecting Power Steering Cooler Hose From Power Steering Pump
Courtesy of GENERAL MOTORS CORP.

6. Disconnect the air reactor tube from the lower reacted tube.
7. Remove the air reacted pipe lower retaining nut.
8. Disconnect the air reactor pipe from the check valve and remove reacted pipe.

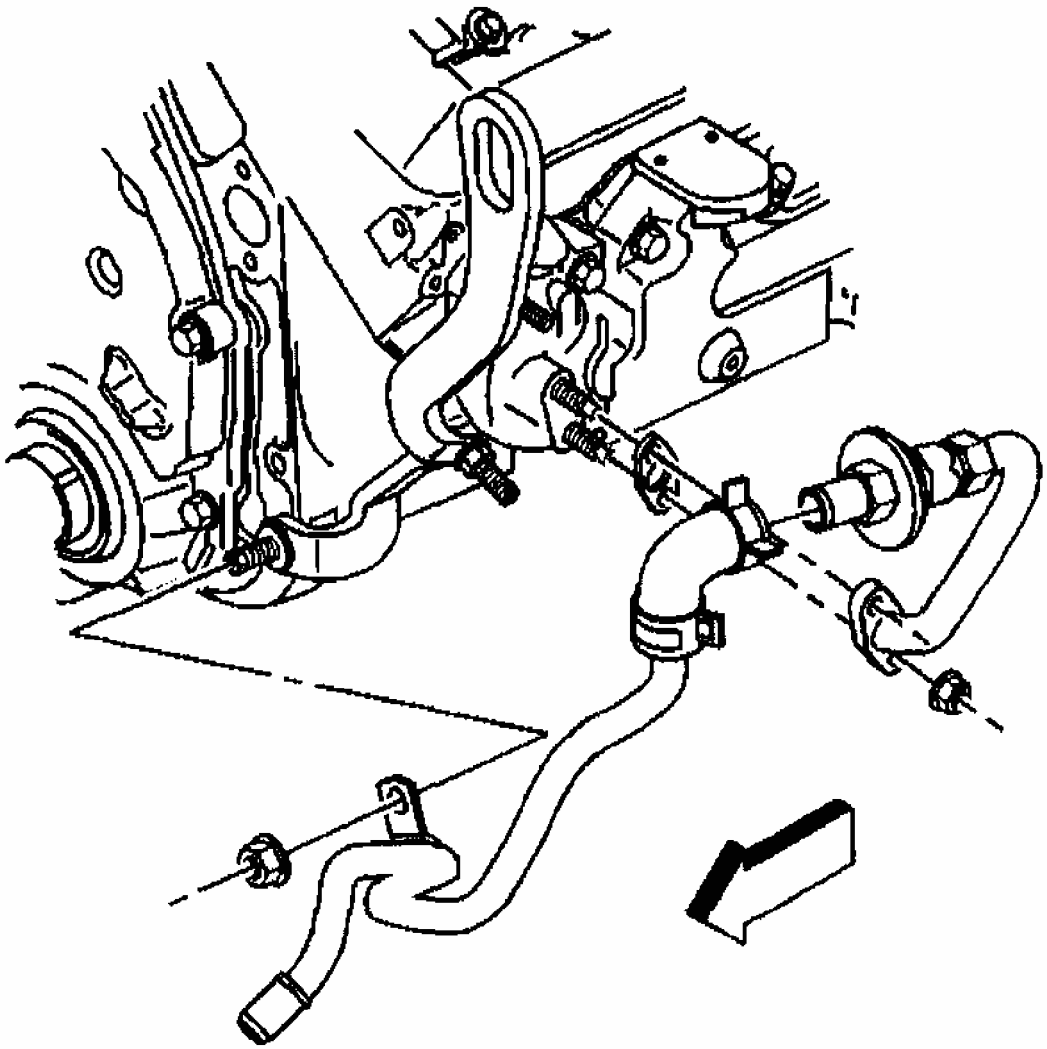

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Fig. 37: Disconnecting Air Reacted Pipe From Check Valve
Courtesy of GENERAL MOTORS CORP.

9. Remove the power steering pump filler neck tube mounting bolt.
10. Remove the power steering pump filler neck tube.

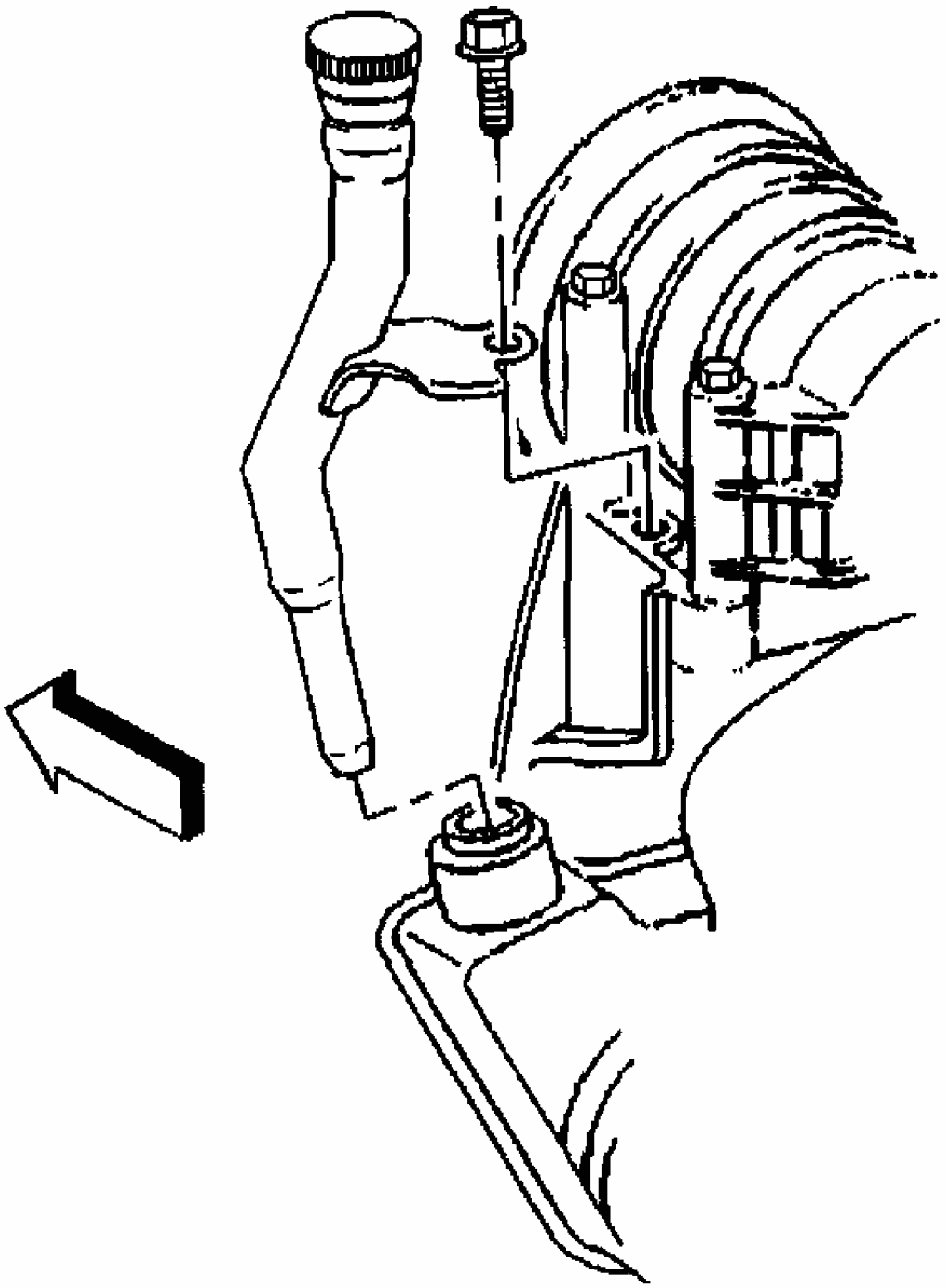

Fig. 38: Power Steering Pump Filler Neck Tube & Tube Mounting Bolt
Courtesy of GENERAL MOTORS CORP.

11. Remove the power steering rear mounting bracket nut from the engine stud.

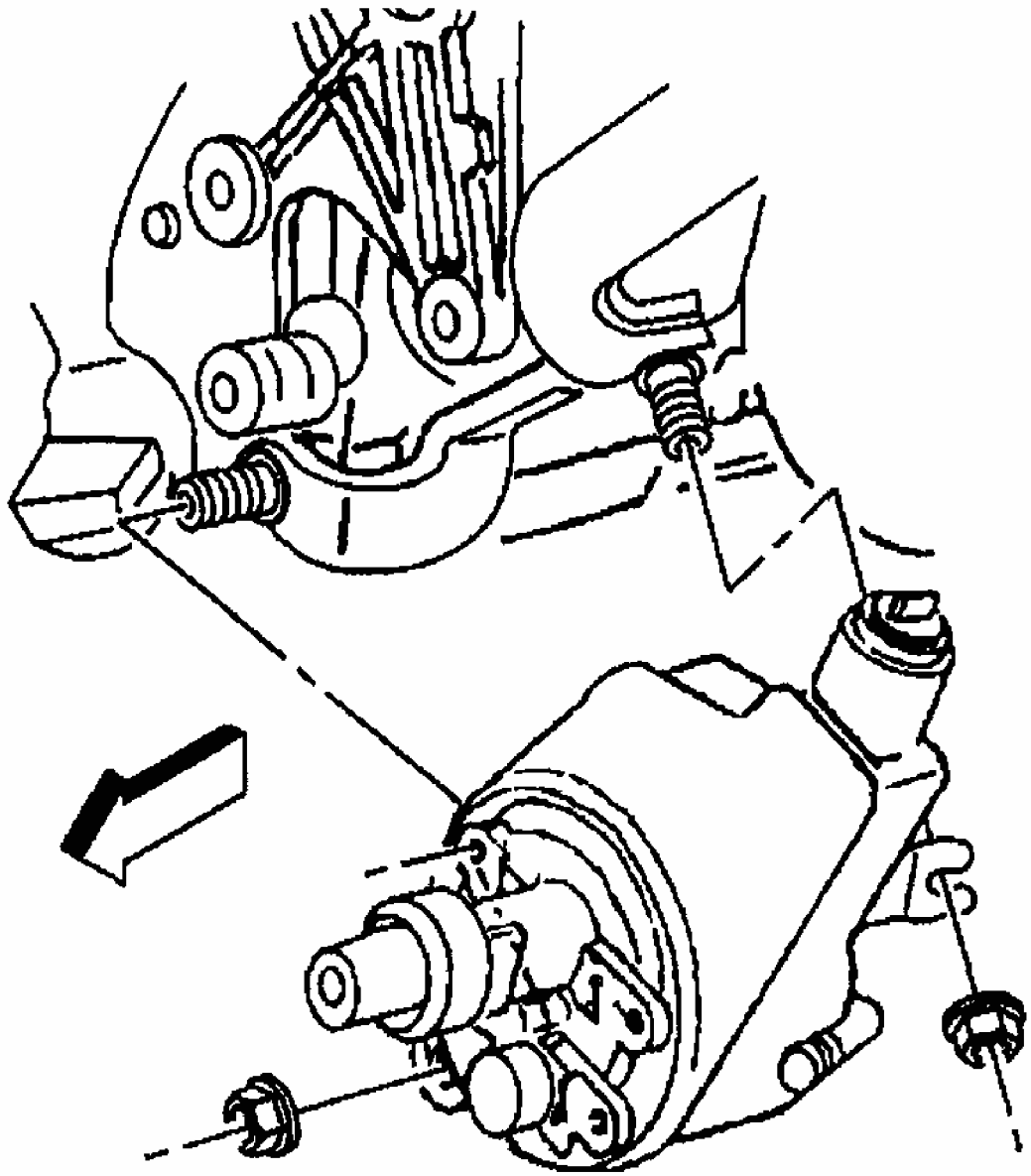

Fig. 39: Power Steering Rear Mounting Bracket Nut
Courtesy of GENERAL MOTORS CORP.

12. Remove the power steering pump front mounting bolts.

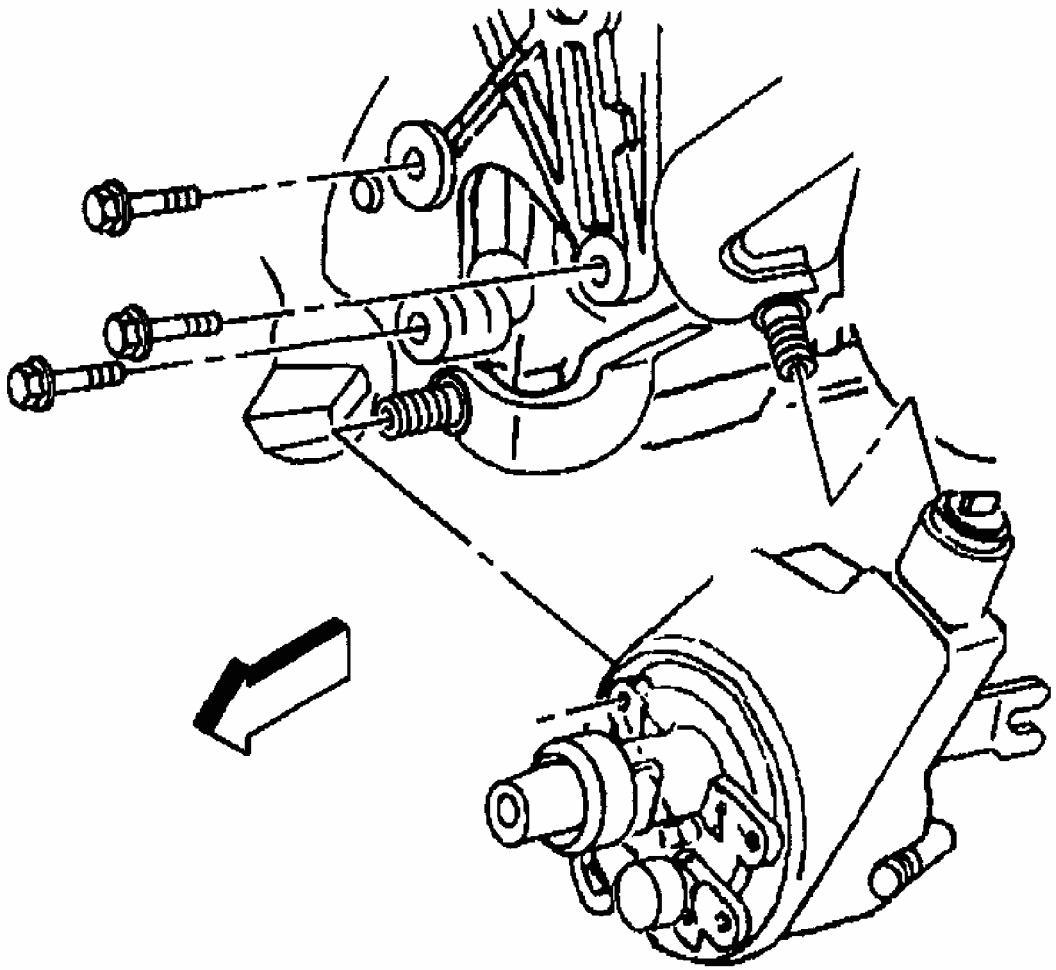

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Fig. 40: Power Steering Pump Front Mounting Bolts
Courtesy of GENERAL MOTORS CORP.

13. Loosen the accessory mounting bracket bolts and nuts and pull accessory mounting bracket forward.
14. Remove the power steering pump and power steering pressure hose from the vehicle.

    Important: Note the position of the power steering pressure hose to the power steering pump to ensure proper installation to the vehicle.

15. Remove the power steering pressure hose from the power steering pump.

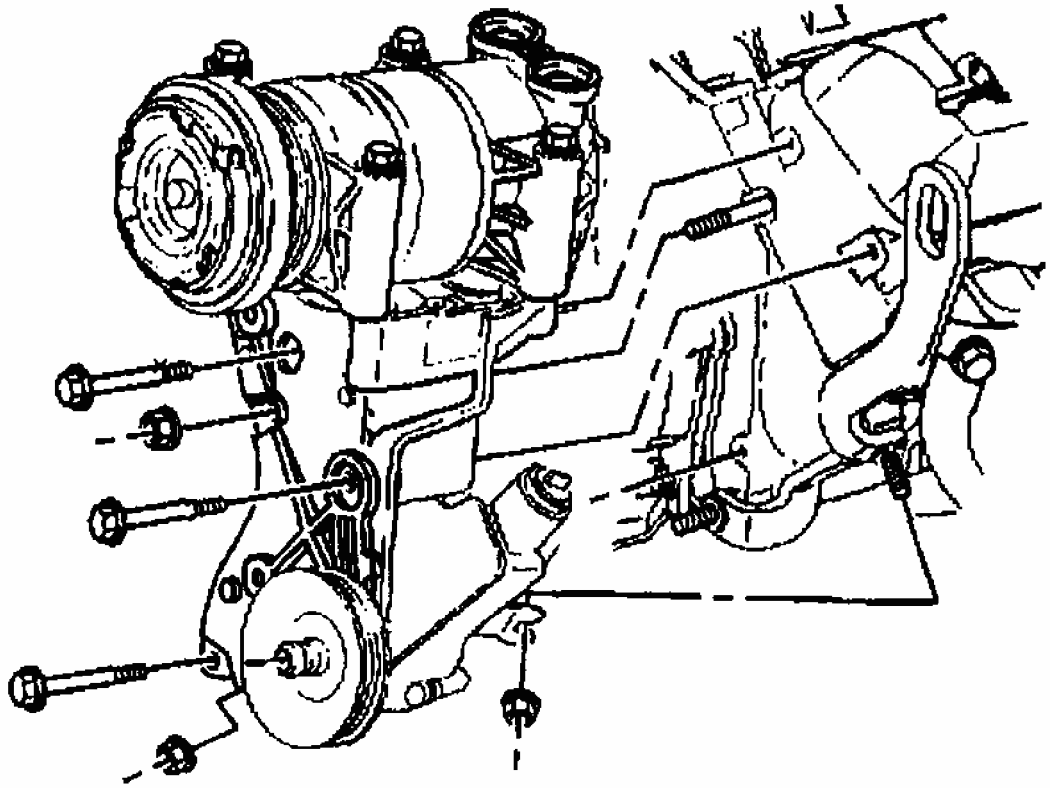

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Fig. 41: Accessory Mounting Bracket Bolts & Nuts
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

NOTE: Refer to FASTENER NOTICE in Cautions and Notices.

1. Install the power steering pressure hose to the power steering pump.

   Tighten

   Tighten the power steering pressure hose to the power steering pump to 25 N.m (18 lb ft).

2. Install the power steering pump and power steering pressure hose to the vehicle.
3. Reposition the accessory mounting bracket and tighten the accessory mounting bracket mounting bolts and nut.

   Tighten

Tighten the accessory mounting bracket mounting bolts and nut to 50 N.m (37 lb ft).

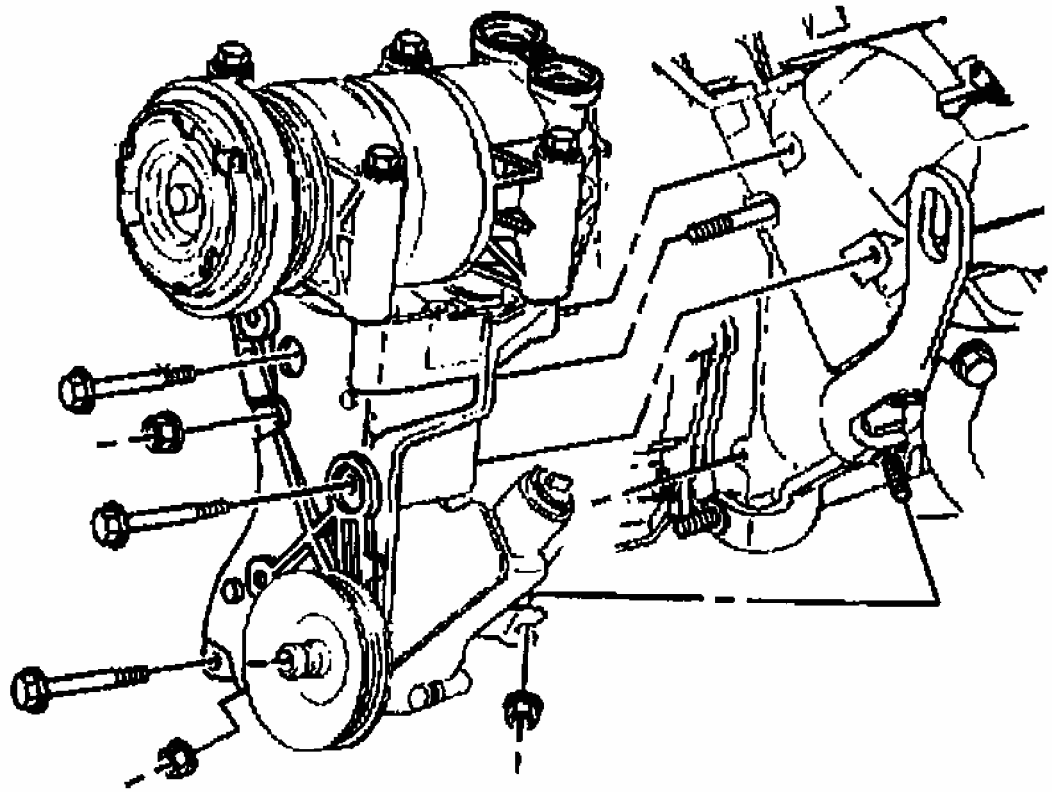

Fig. 42: Tightening Accessory Mounting Bracket Mounting Bolts & Nuts
Courtesy of GENERAL MOTORS CORP.

4. Install the power steering pump front mounting bolts.

Tighten

Tighten the power steering pump front mounting bolts to 50 N.m (37 lb ft).

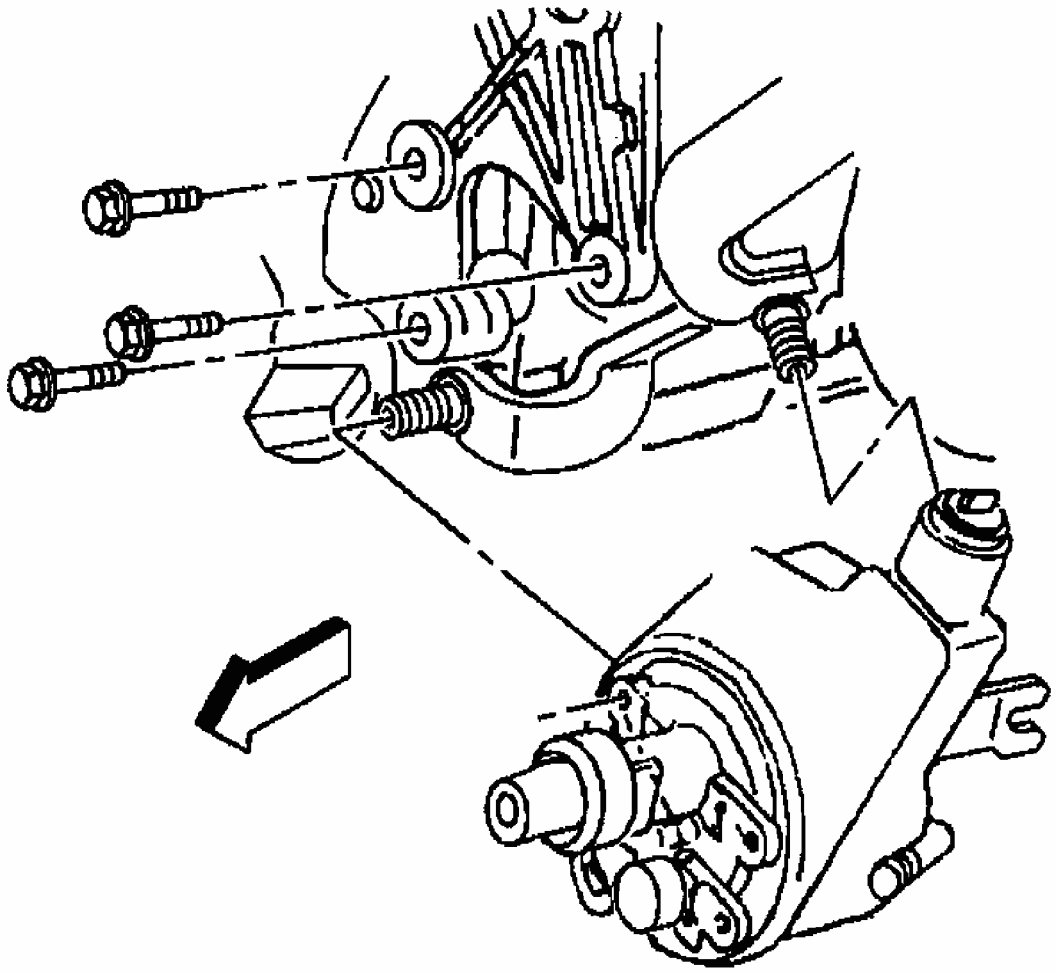

Fig. 43: Tightening Power Steering Pump Front Mounting Bolts
Courtesy of GENERAL MOTORS CORP.

5. Install the power steering pump rear mounting bracket nut to the engine stud.
   Tighten
   Tighten the power steering pump rear mounting bracket nut to 41 N.m (31 lb ft).

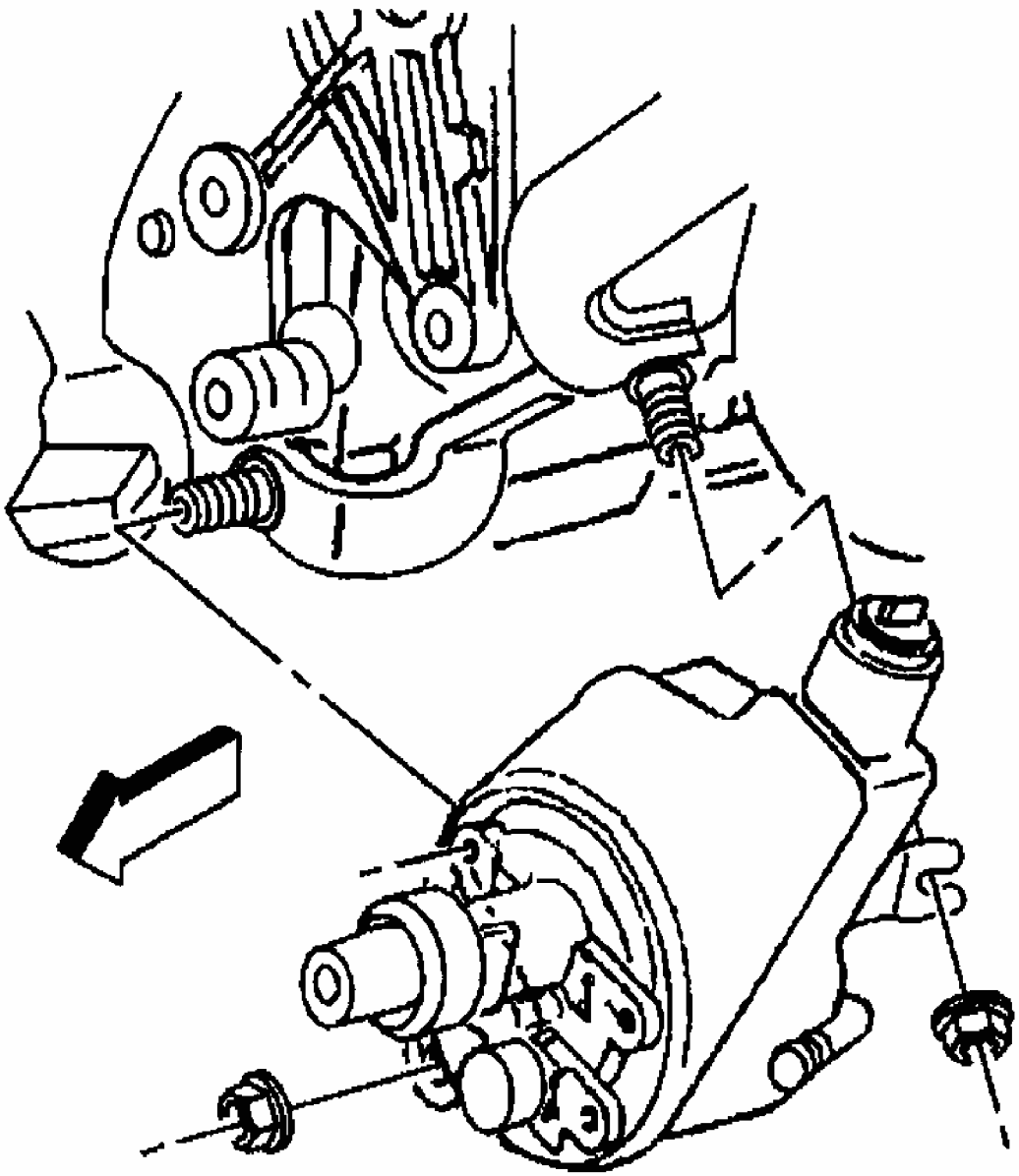

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Fig. 44: Tightening Power Steering Pump Rear Mounting Bracket Nut
Courtesy of GENERAL MOTORS CORP.

6. Install the filler neck tube.
7. Install the filler neck tube mounting bolt.

Tighten

Tighten the filler neck tube mounting bolt to 20 N.m (15 lb ft).

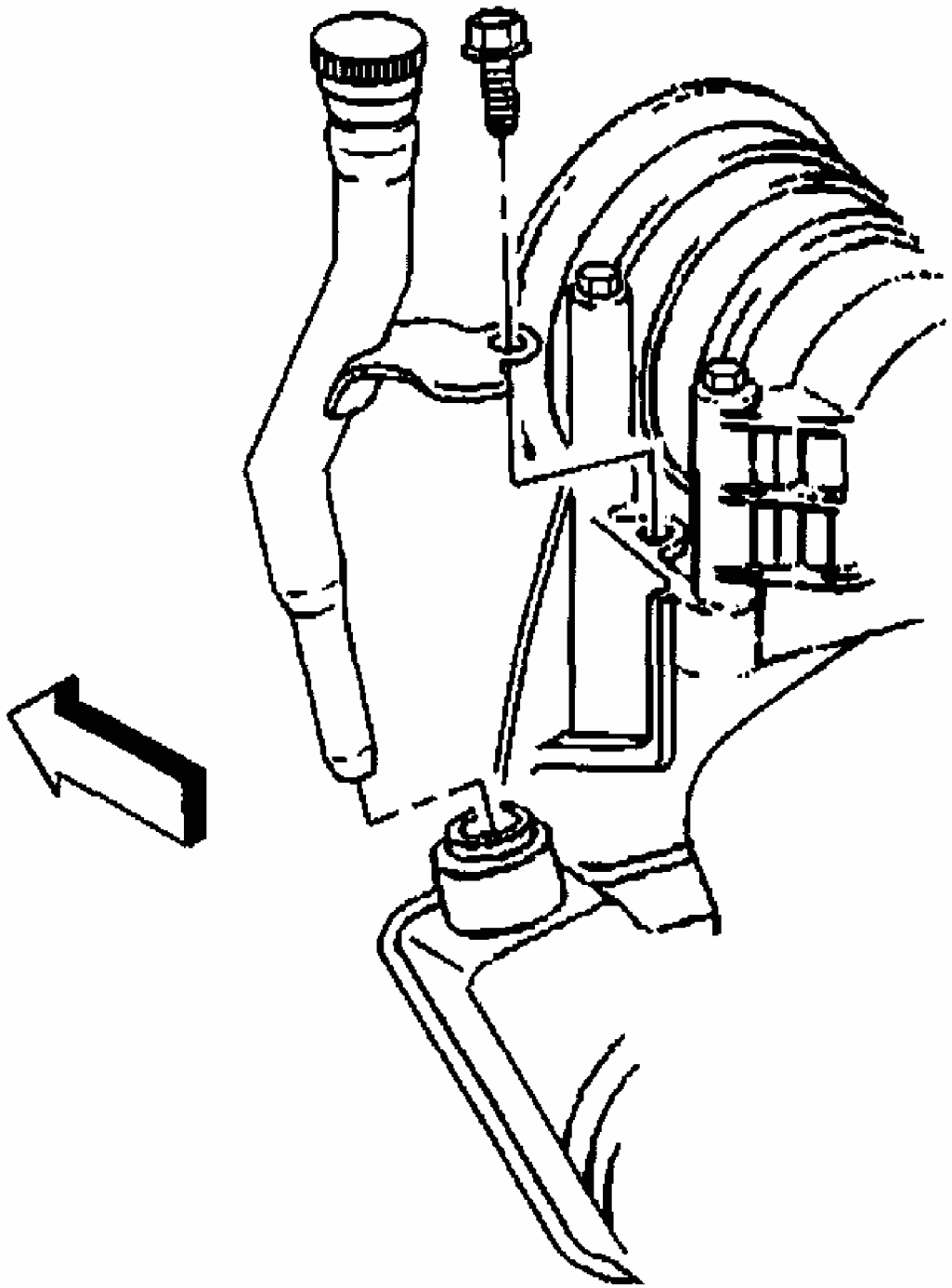

Fig. 45: Filler Neck Tube & Tube Mounting Bolt
Courtesy of GENERAL MOTORS CORP.

8. Connect the lower secondary air injection reactor pipe to the check valve.
9. Install the lower secondary air injection reactor pipe bracket to the power steering pump bracket stud.
10. Install the power steering pump mounting bracket retaining nut.

    Tighten

    Tighten the power steering pump mounting bracket retaining nut to 41 N.m (31 lb ft).

11. Connect the lower secondary air injection reactor pipe lower connection.

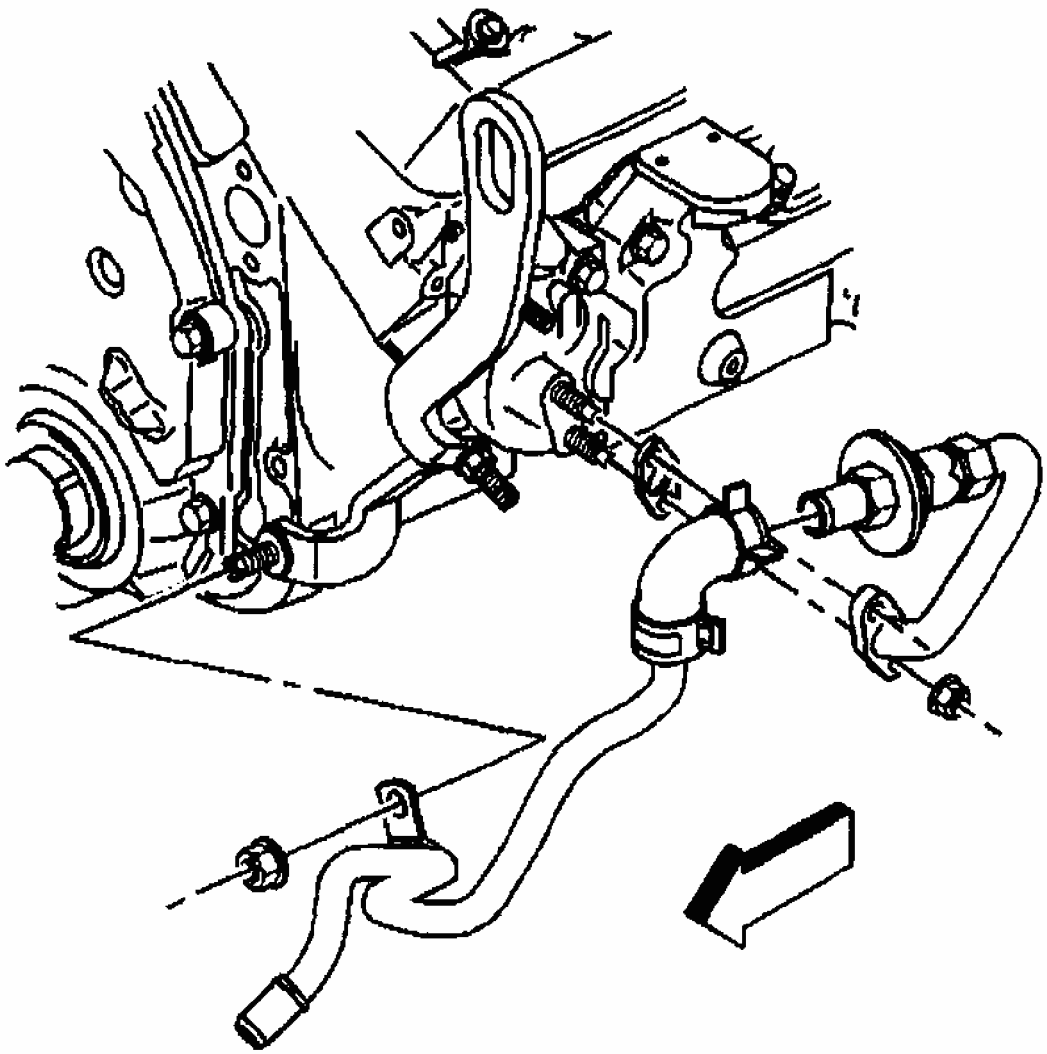

Fig. 46: Connecting Lower Secondary Air Injection Reactor Pipe To Check Valve

Courtesy of GENERAL MOTORS CORP.

12. Connect the power steering cooler hose to the power steering pump.

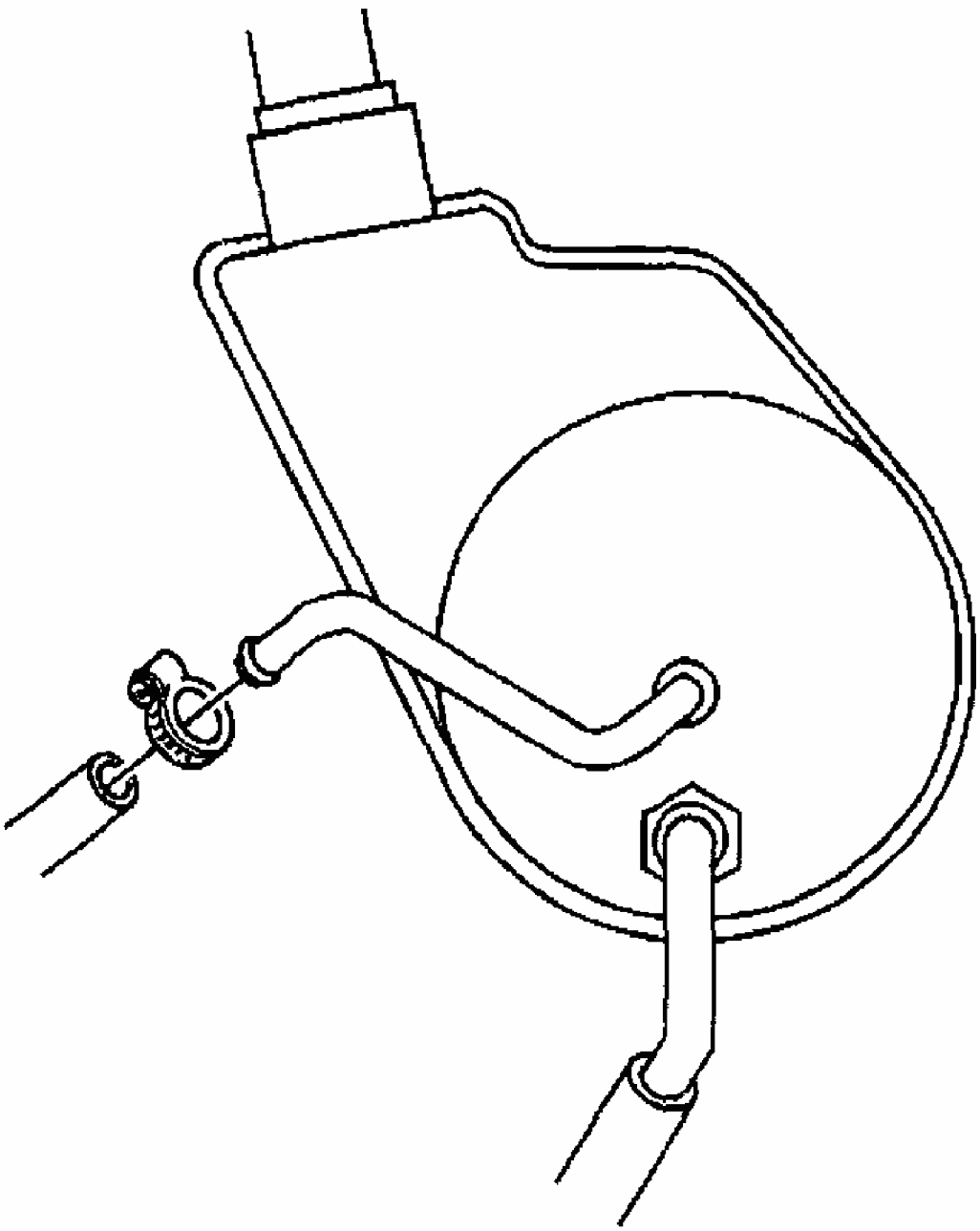

Fig. 47: Connecting Power Steering Cooler Hose To Power Steering Pump
Courtesy of GENERAL MOTORS CORP.

13. Connect the power steering pressure hose to the power steering gear.

    Tighten

    Tighten the power steering pressure hose to the power steering gear to 30 N.m (22 lb ft).

14. Install the power steering pump pulley. Refer to **POWER STEERING PULLEY REPLACEMENT** .
15. Install the air cleaner assembly. Refer to AIR CLEANER ASSEMBLY REPLACEMENT in Engine Controls 4.3L.
16. Remove the drain pan from under the vehicle.
17. Fill the power steering system.
18. Bleed the system. Refer to **BLEEDING THE POWER STEERING SYSTEM** .
19. Inspect the hoses for clearance away from the frame and other components.

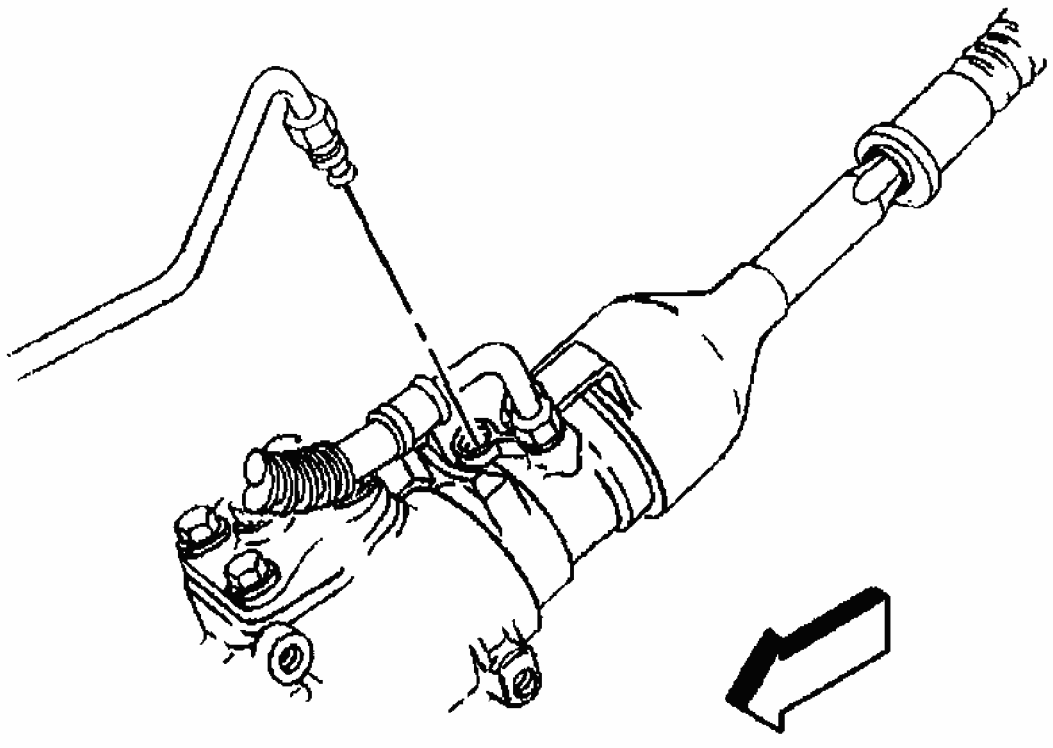

Fig. 48: Tightening Power Steering Pressure Hose To Power Steering Gear
Courtesy of GENERAL MOTORS CORP.

POWER STEERING RESERVOIR REPLACEMENT - OFF VEHICLE (CB SERIES)

Disassembly Procedure

1. Place the hydraulic pump (1) on a fixed, flat surface, with the shaft facing upward.
2. Insert a screwdriver into the retaining clip tab (3).
3. Using the screwdriver, force the retaining clip tab (3) outward.
4. Slide the reservoir clip (4) away from the hydraulic pump assembly (1).
5. Repeat the above steps to remove the second reservoir clip (4).
6. Remove the reservoir (2) from the hydraulic pump housing (1).
7. Remove the O-ring seal from the neck of the reservoir (2) or inside the hydraulic pump housing (1). Discard the O-ring seal.

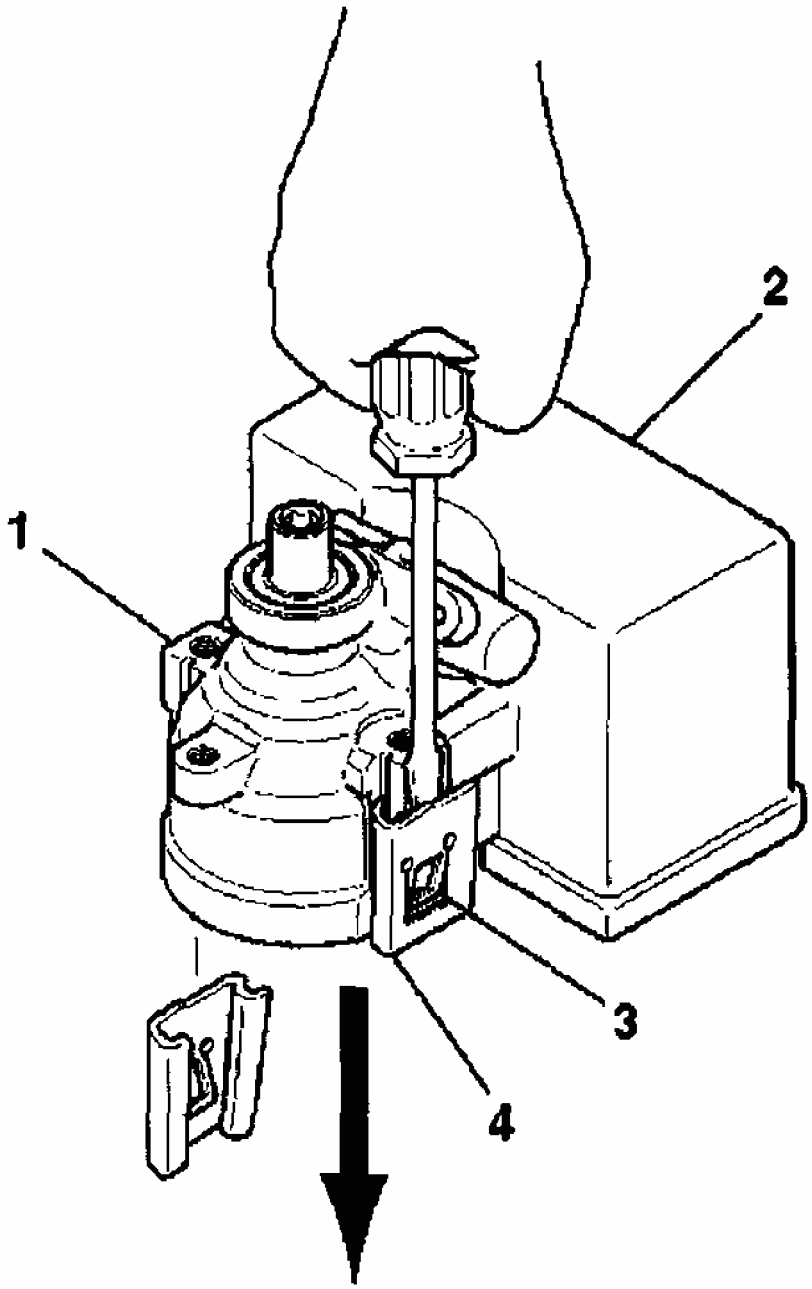

Fig. 49: Disconnecting Retaining Clip Tab Using Screwdriver
Courtesy of GENERAL MOTORS CORP.

Assembly Procedure

1. Lubricate the new O-ring seal with power steering fluid.
2. Install the new O-ring seal onto the neck of the reservoir (2).

3. Install the reservoir (2) onto the hydraulic pump assembly (1). Ensure the reservoir neck is completely engaged onto the hydraulic pump assembly (1).
4. Align the feet of the reservoir with the sides of the hydraulic pump housing.
5. Install the new reservoir retaining clips (4) (supplied with the pump). Ensure the retaining clip tabs (3) fully engage with the hydraulic pump housing (1).

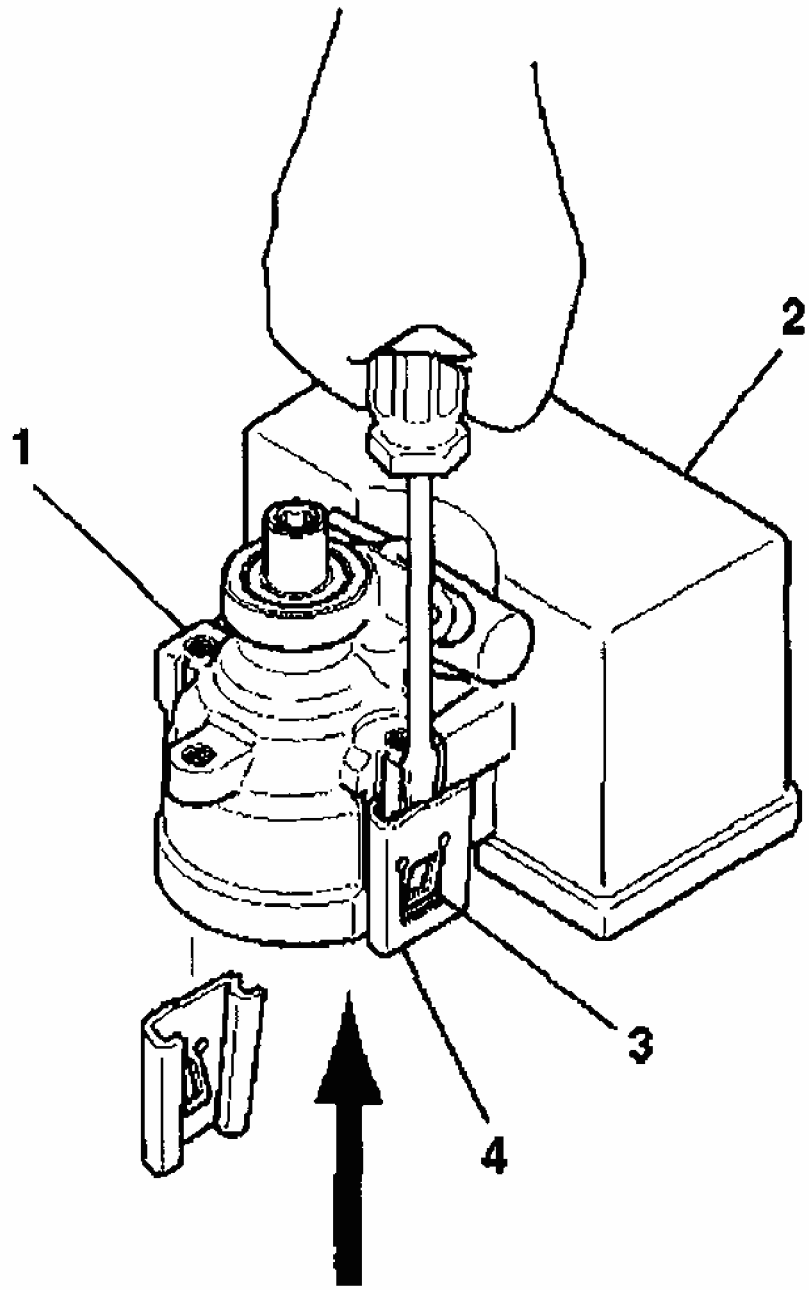

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Fig. 50: New Reservoir Retaining Clip
Courtesy of GENERAL MOTORS CORP.

POWER STEERING RESERVOIR REPLACEMENT - OFF VEHICLE (P SERIES)

Disassembly Procedure

1. Drain the power steering fluid from the power steering pump.
2. Remove the pump mounting studs (2).
3. Remove the connector and fitting assembly (4).
4. Remove the O-ring seal (3).

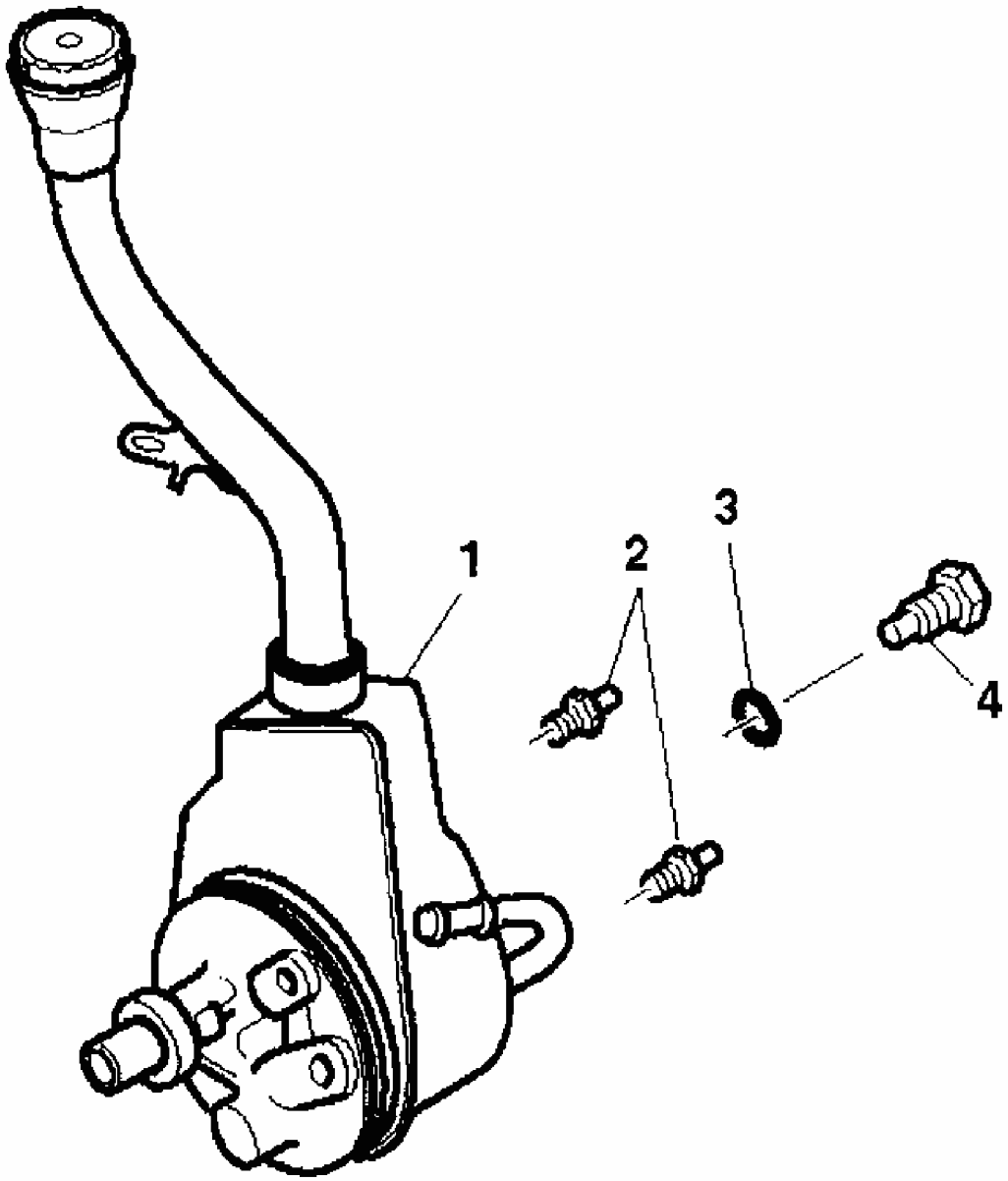

Fig. 51: Removing O-Ring Seal, Connector & Pump Mounting Studs
Courtesy of GENERAL MOTORS CORP.

5. Remove the reservoir assembly (1) from the pump housing assembly (2).

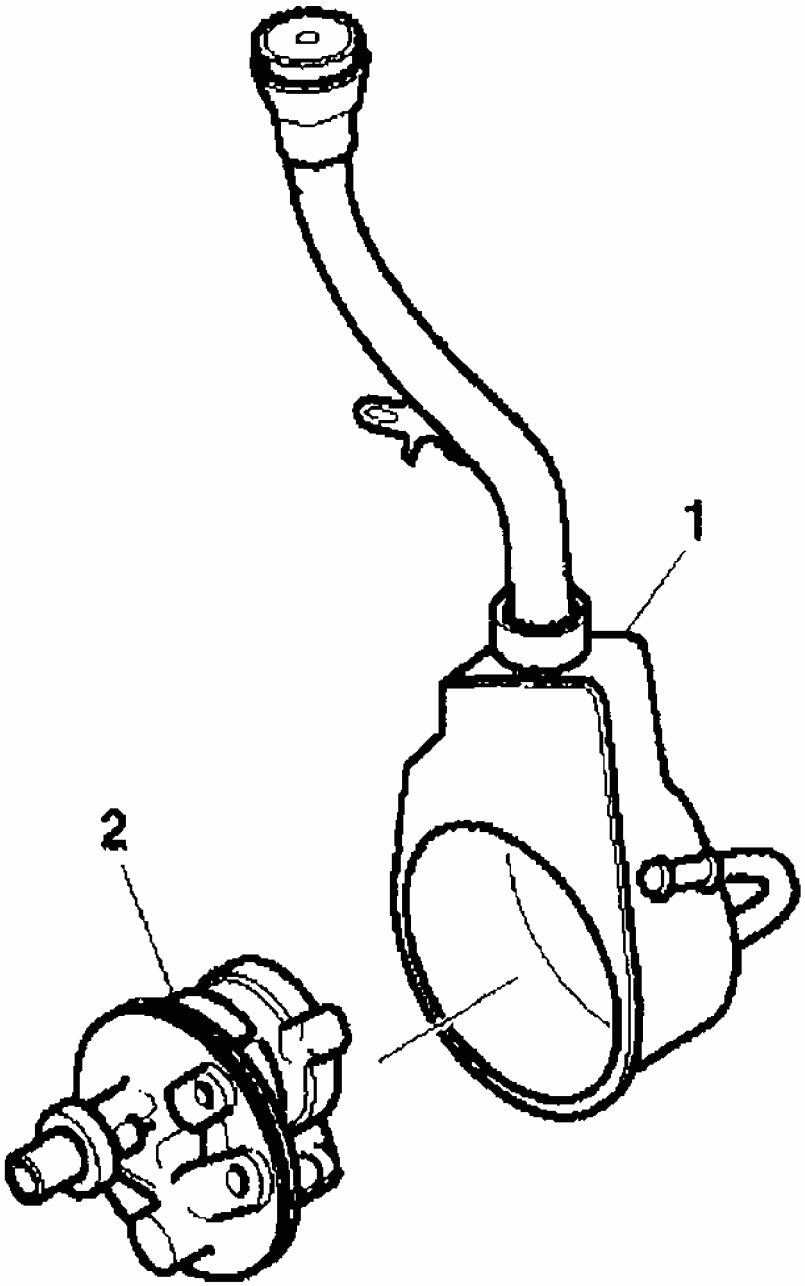

Fig. 52: Removing Reservoir Assembly From Pump Housing Assembly
Courtesy of GENERAL MOTORS CORP.

6. Remove the O-ring seals (1) (4) (5).
7. Remove the magnet (3).
8. Clean the magnet (3).

9. Inspect the welch plug in the power steering pump housing (2). Do not remove. If the welch plug is deformed or dislodged, replace the power steering pump housing (2).

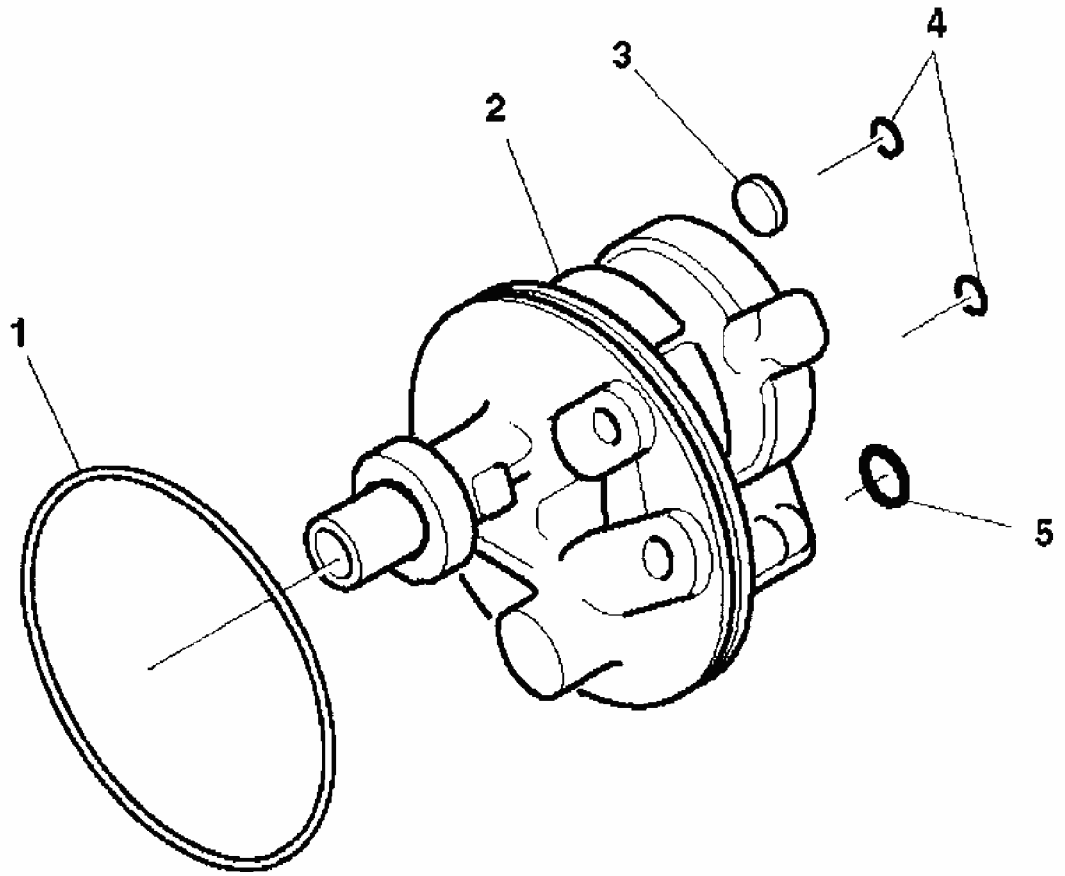

Fig. 53: Removing O-Ring Seals, Magnet & Inspecting Welch Plug In Power Steering Pump Housing
Courtesy of GENERAL MOTORS CORP.

Assembly Procedure

Important: Use new O-ring seals when assembling the power steering pump assembly.

1. Lubricate the O-ring seals (1) (4) (5) with power steering fluid.
2. Install the O-ring seals (1) (4) (5) to the pump housing assembly.
3. Install the magnet (3) to the pump housing assembly (2).

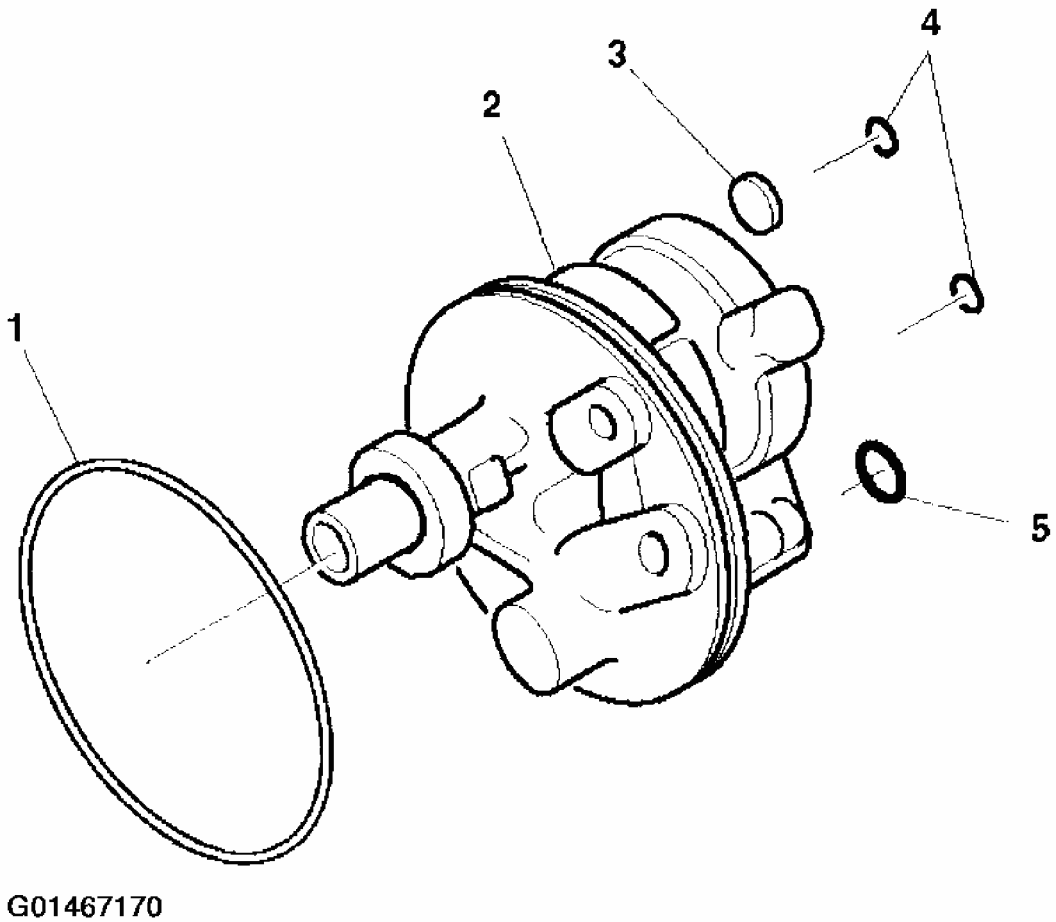

Fig. 54: Installing O-Ring Seal & Magnet To Pump Housing Assembly
Courtesy of GENERAL MOTORS CORP.

4. Connect the reservoir assembly (1) to the pump housing assembly (2).

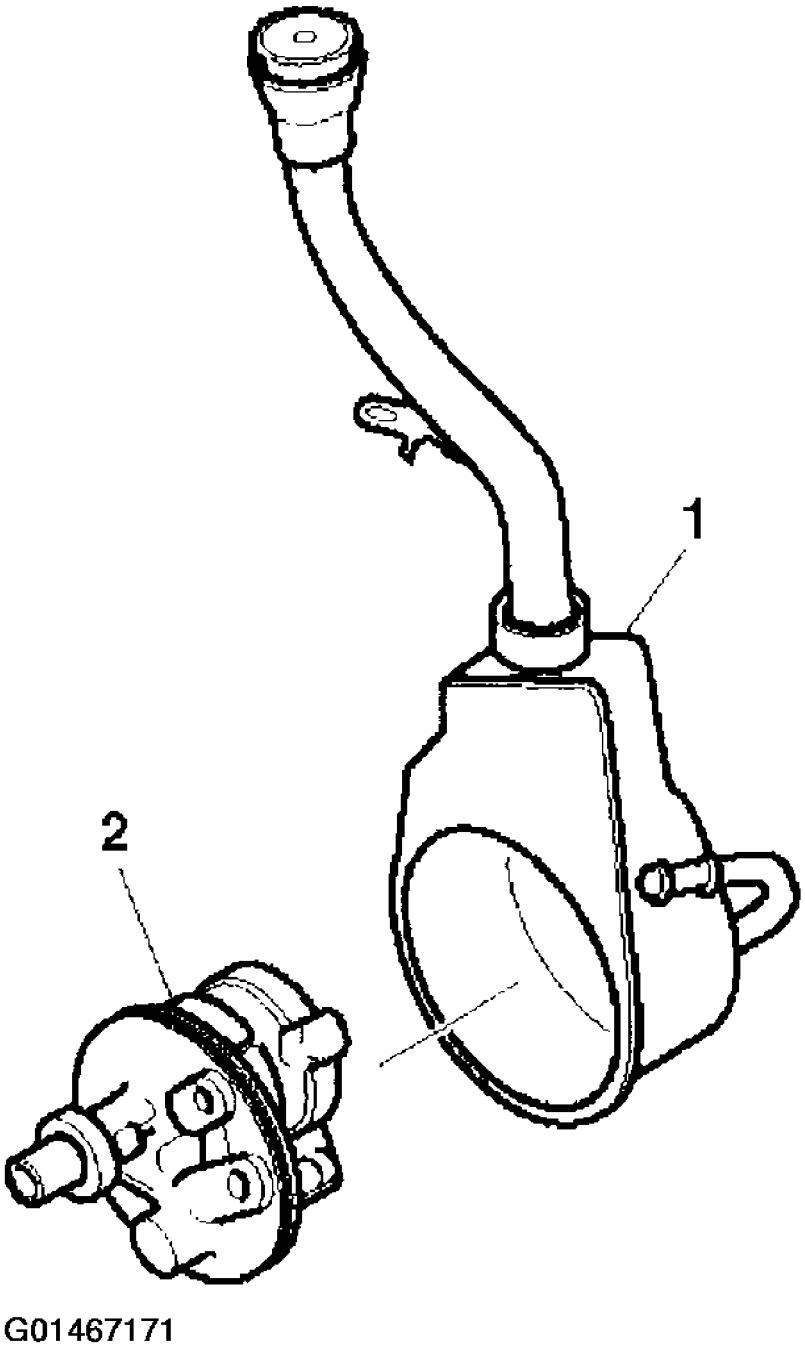

Fig. 55: Connecting Reservoir Assembly To Pump Housing Assembly
Courtesy of GENERAL MOTORS CORP.

5. Install the O-ring seal.

NOTE: Refer to FASTENER NOTICE in Cautions and Notices.

6. Install the connector and fitting assembly (4) to the pump housing (1).

   Install the pump mounting studs (2) to the pump housing (1).

   Tighten

   Tighten the pump mounting studs (2) to 35-80 N.m (29-59 lb ft).

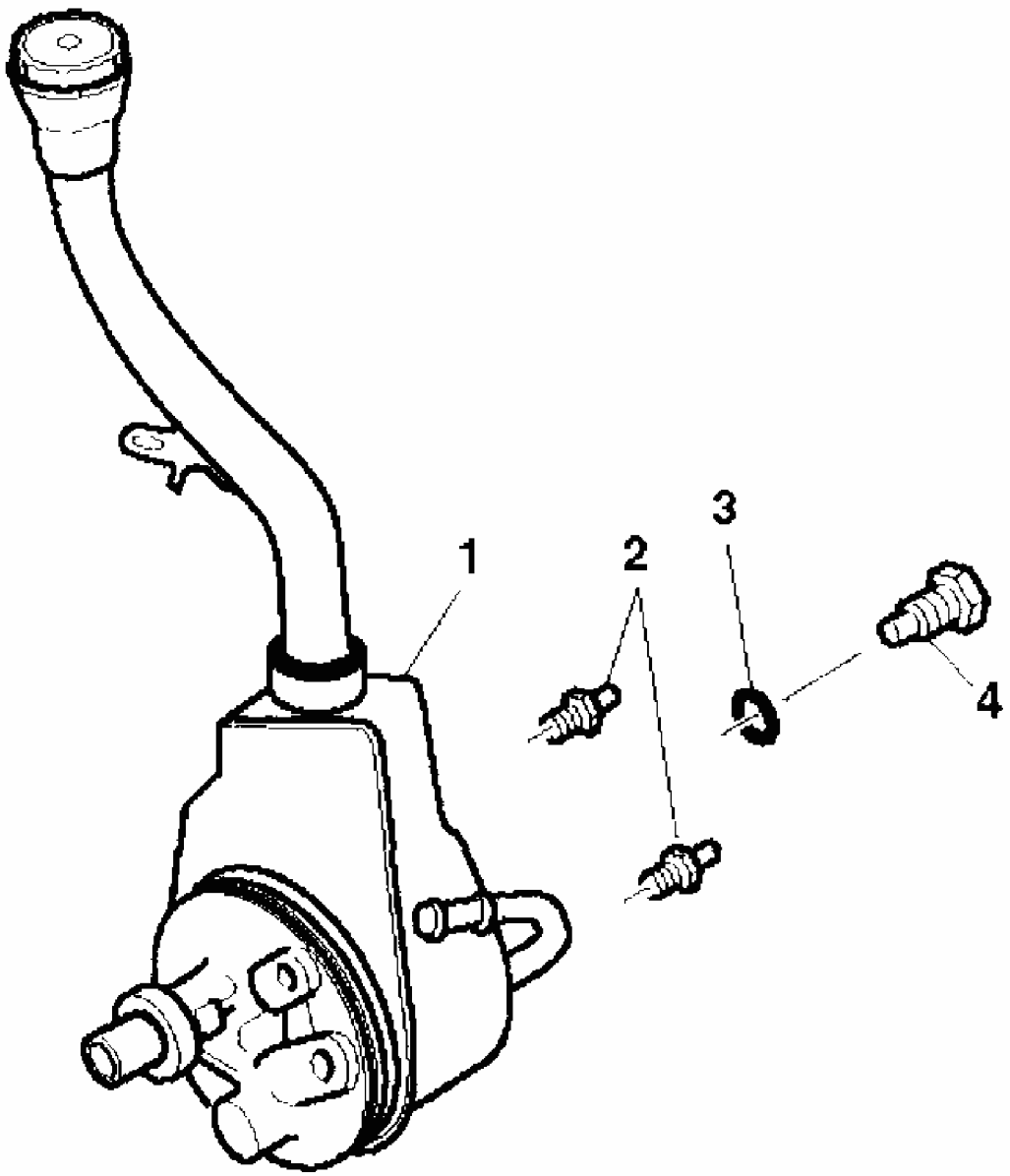

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Fig. 56: Installing O-Ring Seal & Pump Mounting Studs To Pump Housing
Courtesy of GENERAL MOTORS CORP.

POWER STEERING PUMP FLOW CONTROL VALVE REPLACEMENT - OFF VEHICLE (CB SERIES)

Disassembly Procedure

1. Remove the connector and fitting assembly (4).
2. Remove the O-ring seal (3).

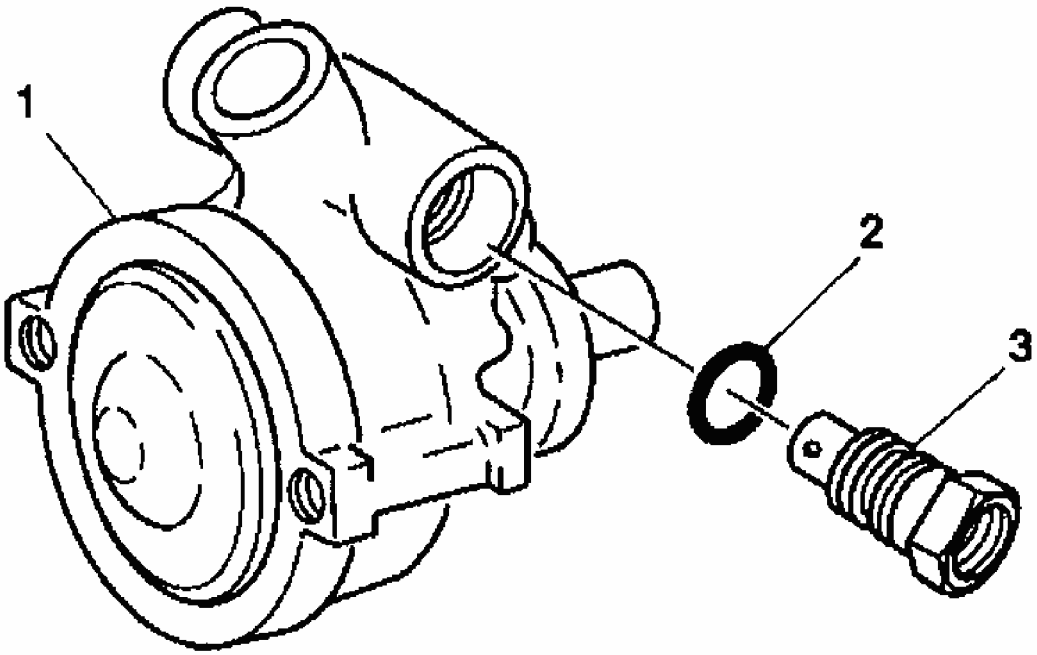

Fig. 57: Connector & O-Ring Seal
Courtesy of GENERAL MOTORS CORP.

3. Remove the control valve assembly (3) and the flow control spring (2) from the pump housing assembly (1).

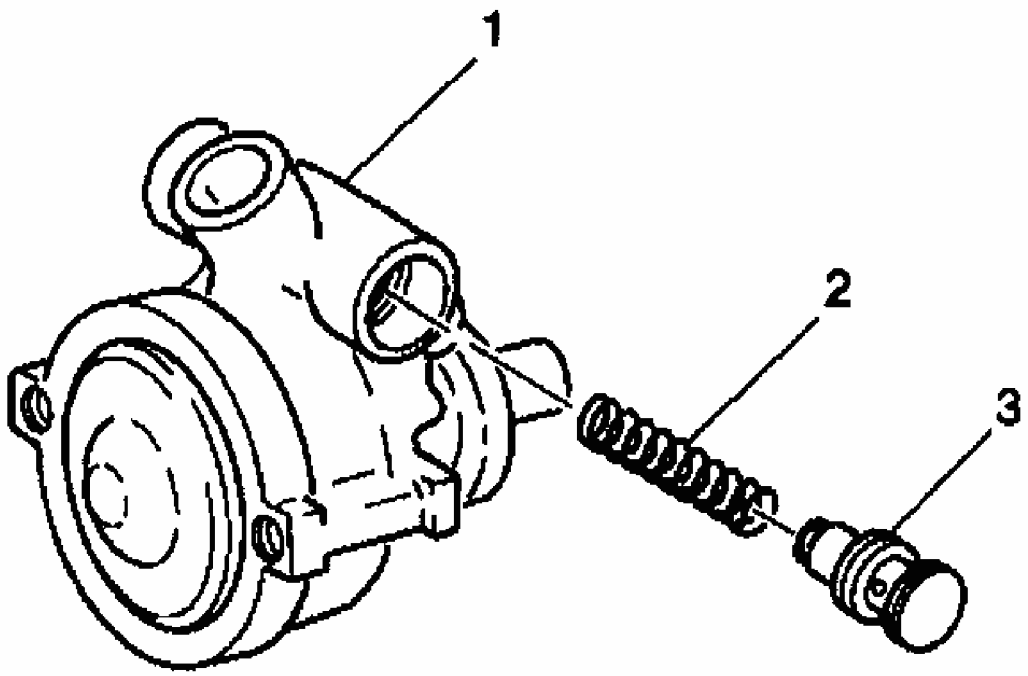

Fig. 58: Removing Control Valve Assembly & Flow Control Spring From Pump Housing Assembly
Courtesy of GENERAL MOTORS CORP.

Assembly Procedure

1. Install the flow control spring (2) to the pump housing assembly (1).
2. Install the control valve assembly (3) to the flow control spring (2).

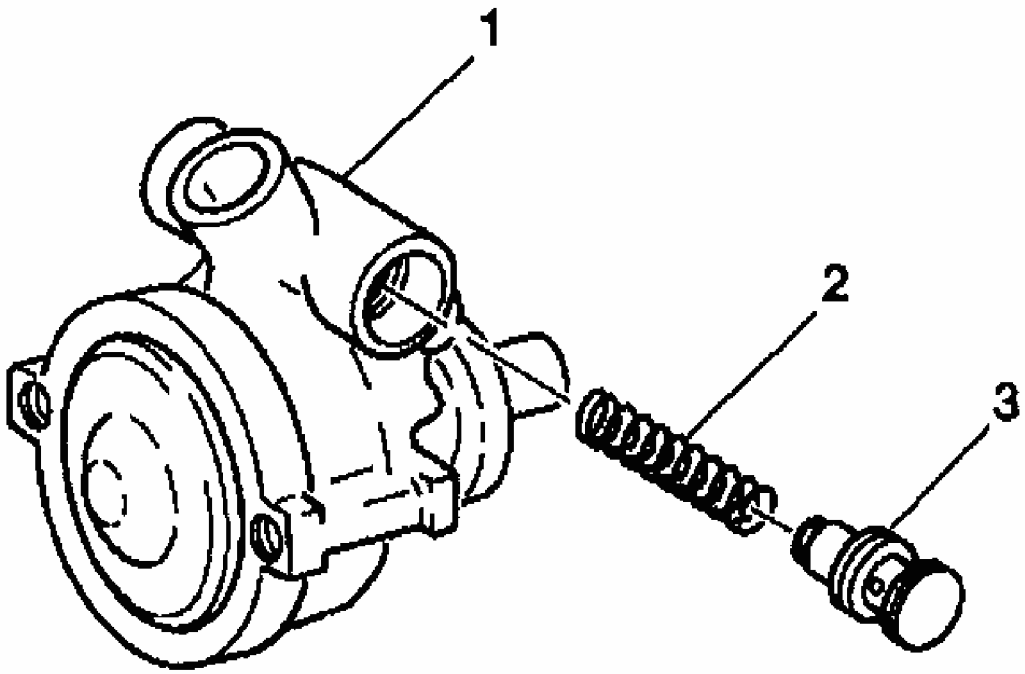

Fig. 59: Installing Control Valve Assembly & Flow Control Spring To Pump Housing Assembly
Courtesy of GENERAL MOTORS CORP.

3. Lubricate the O-ring seal (3) with power steering fluid.
4. Install the O-ring seal (3).

NOTE: Refer to FASTENER NOTICE in Cautions and Notices.

5. Install the connector and fitting assembly (3) to the pump housing (1).

Tighten

Tighten the connector and fitting assembly (3) to 75 N.m (55 lb ft).

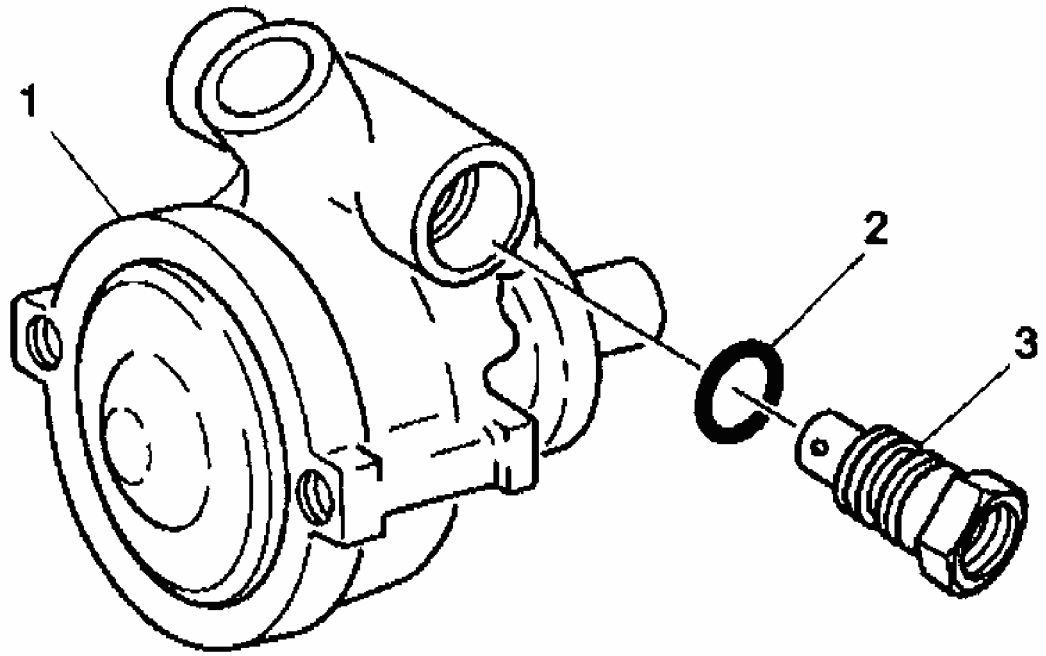

Fig. 60: Installing Connector & O-Ring Seal To Pump Housing
Courtesy of GENERAL MOTORS CORP.

POWER STEERING PUMP FLOW CONTROL VALVE REPLACEMENT - OFF VEHICLE (P SERIES)

Disassembly Procedure

1. Drain the power steering fluid from the power steering pump.
2. Remove the connector and fitting assembly (4).
3. Remove the O-ring seal (3).

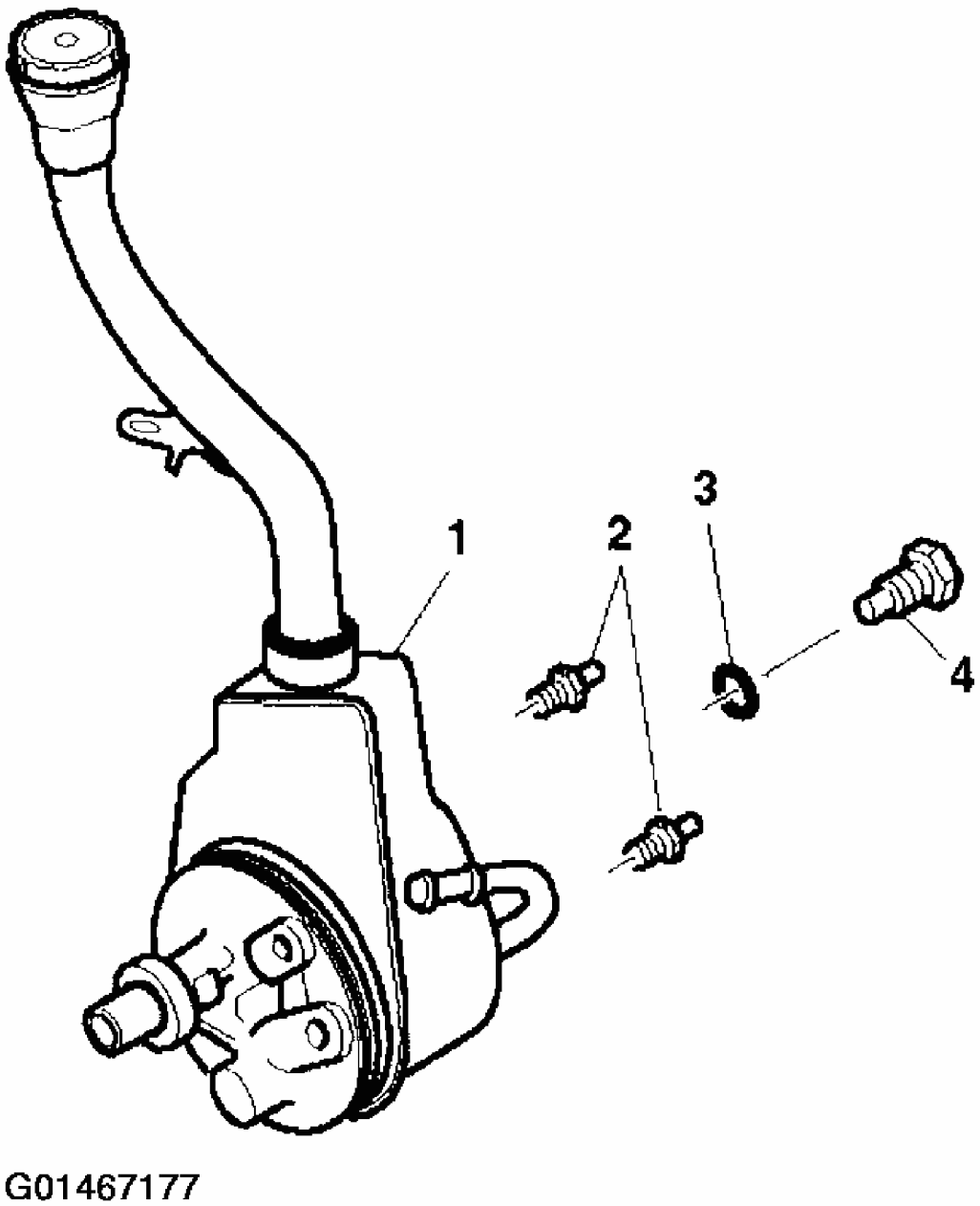

Fig. 61: Removing Connector & O-Ring Seal From Pump Housing (P Series)
Courtesy of GENERAL MOTORS CORP.

4. Remove the control valve assembly (3) and the flow control spring (2) from the pump housing assembly (1).

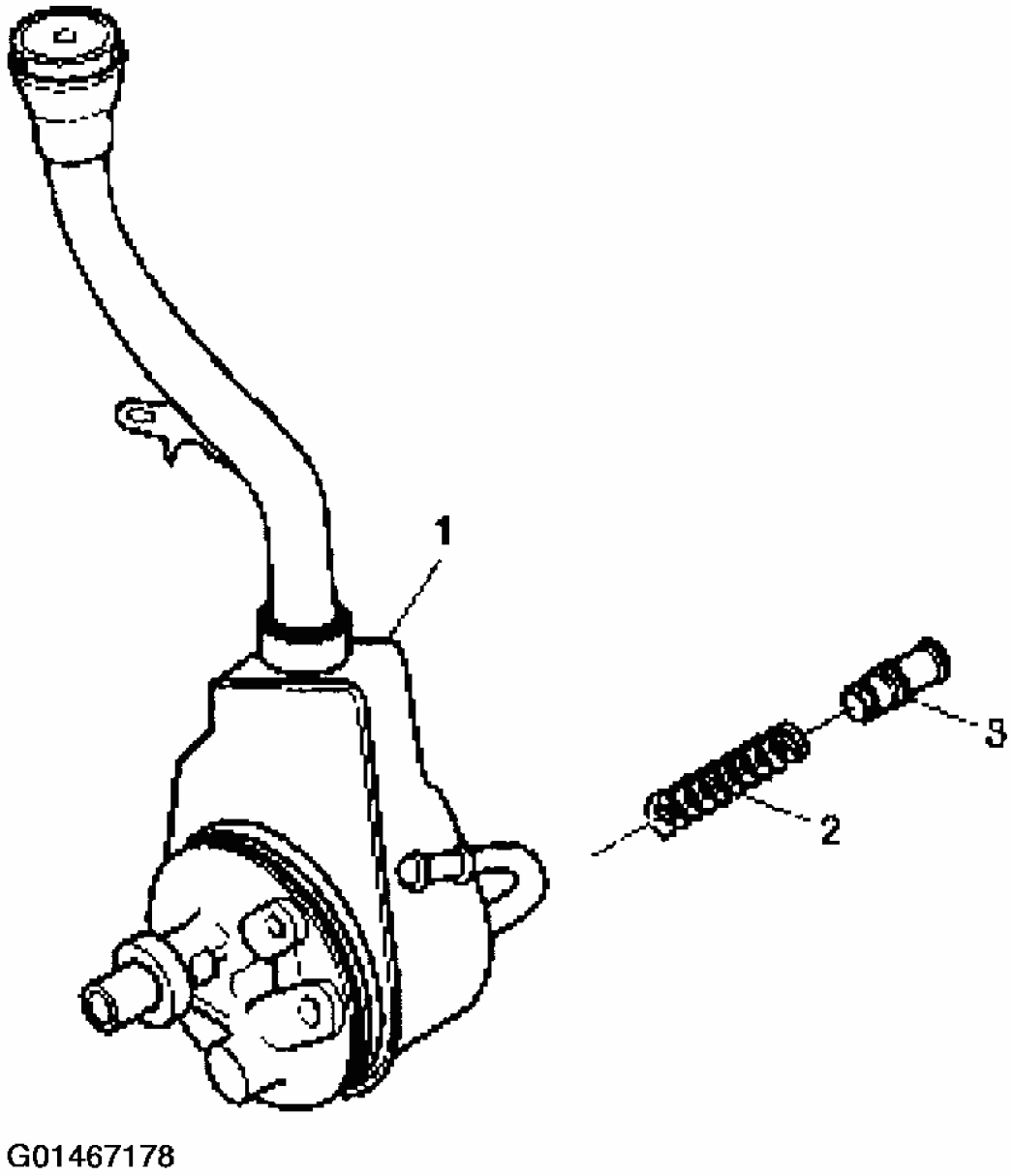

Fig. 62: Removing Control Valve Assembly & Flow Control Spring From Pump Housing Assembly
Courtesy of GENERAL MOTORS CORP.

Assembly Procedure

1. Install the flow control spring (2) to the pump housing assembly (1).
2. Install the control valve assembly (3) to the flow control spring (2).

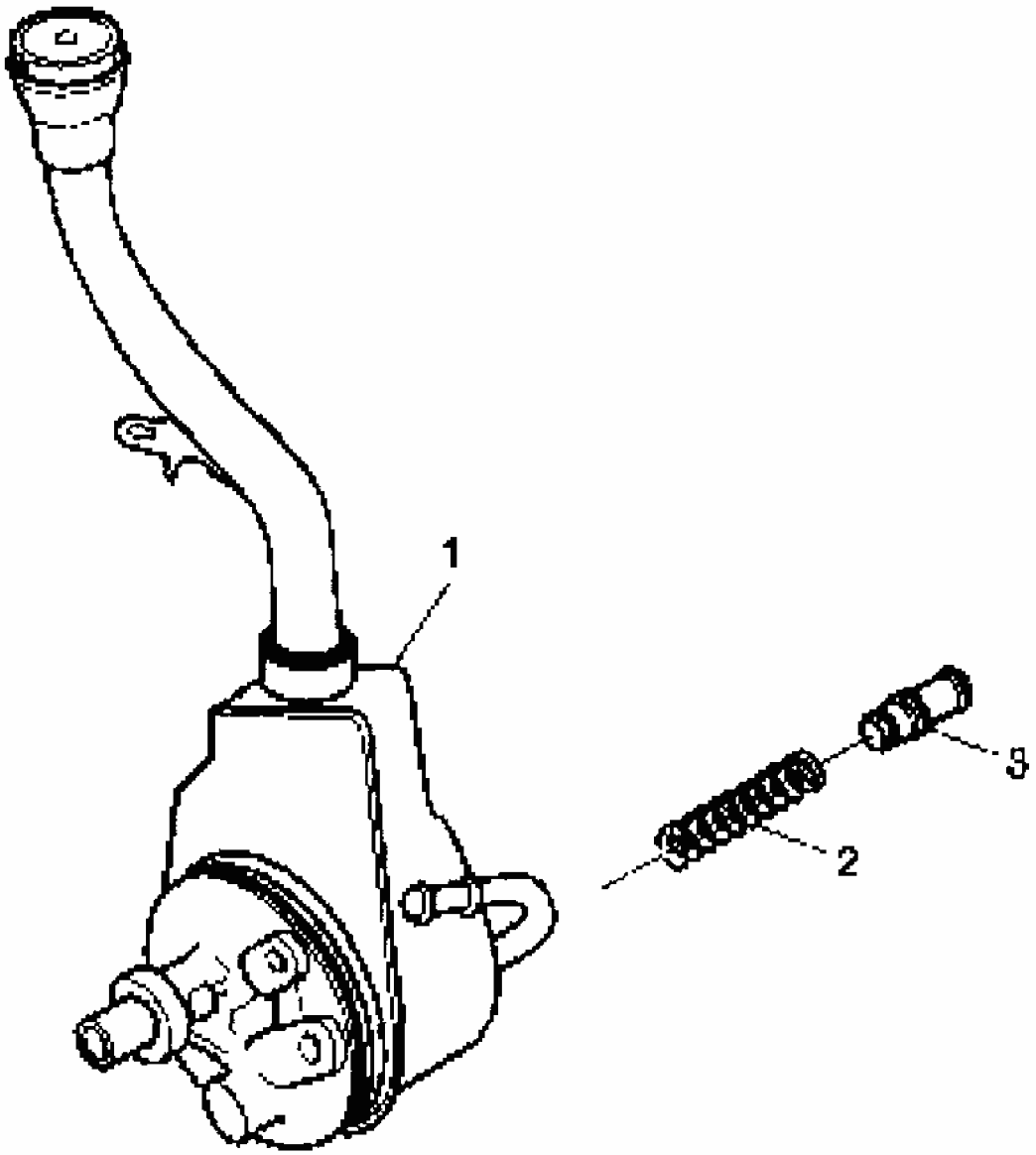

Fig. 63: Installing Flow Control Spring & Control Valve Assembly To Pump Housing Assembly
Courtesy of GENERAL MOTORS CORP.

3. Install the O-ring seal (3) to the connector and fitting assembly (4).

NOTE: Refer to FASTENER NOTICE in Cautions and Notices.

4. Install the connector and fitting assembly (4) to the pump housing (1).

Tighten

Tighten the connector and fitting assembly (4) to 75 N.m (55 lb ft).

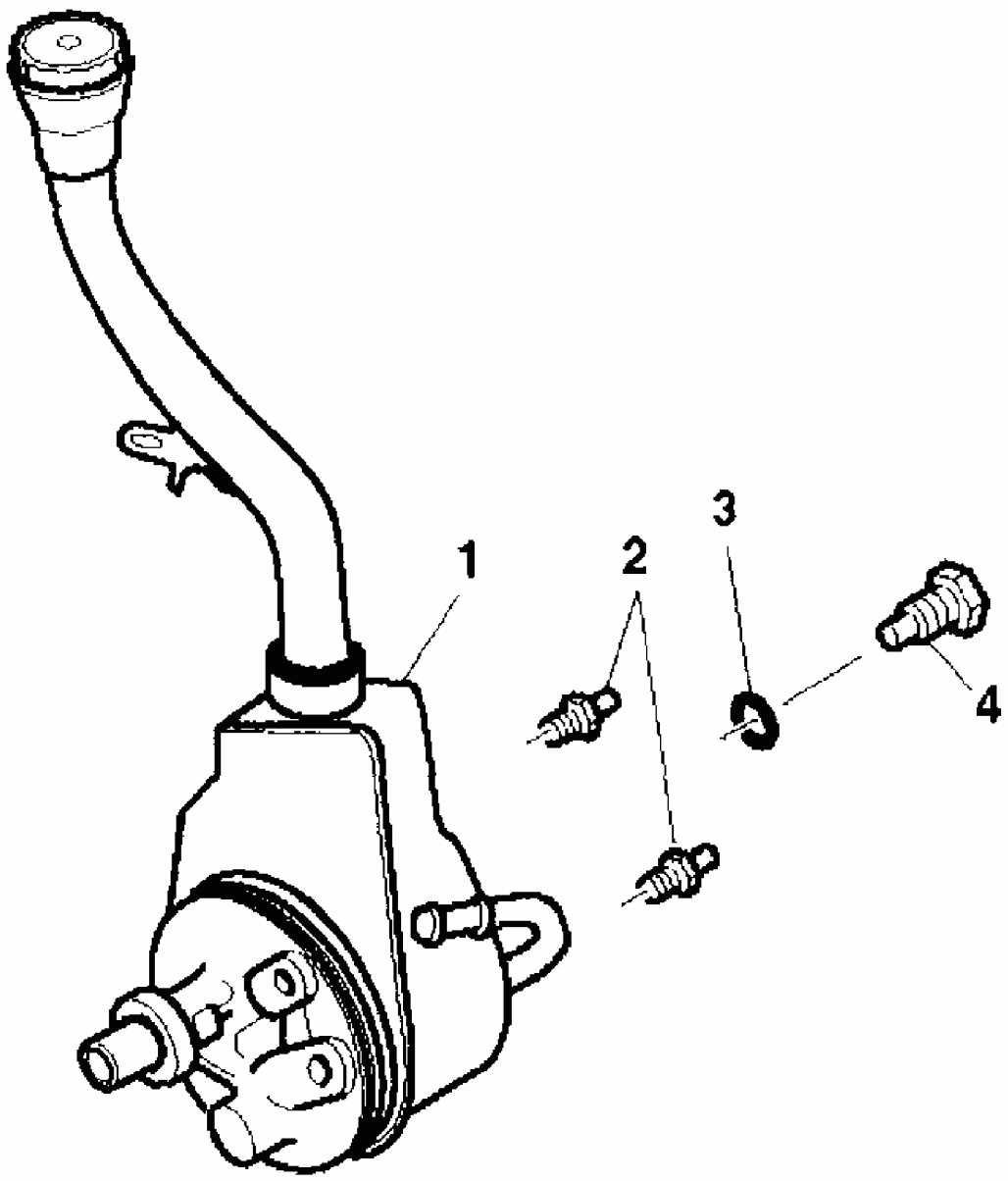

Fig. 64: Installing Connector & O-Ring Seal To Pump Housing Assembly
Courtesy of GENERAL MOTORS CORP.

PITMAN SHAFT SEAL REPLACEMENT - ON VEHICLE (RWD)

Tools Required

- *J 4245* Internal Snap Ring Pliers
- *J 6219* Pitman Shaft Oil Seal Installer

Removal Procedure

1. Remove the pitman arm from the pitman shaft. Refer to **PITMAN ARM REPLACEMENT (RWD)** or **PITMAN ARM REPLACEMENT (4WD)** in Steering Linkage.
2. Remove the snap ring (1) using *J 4245* .
3. Place a drain pan under the steering gear.
4. Start the engine.
5. Turn the steering wheel from stop to stop. Bounce the wheel off the stops.
6. Turn OFF the engine.

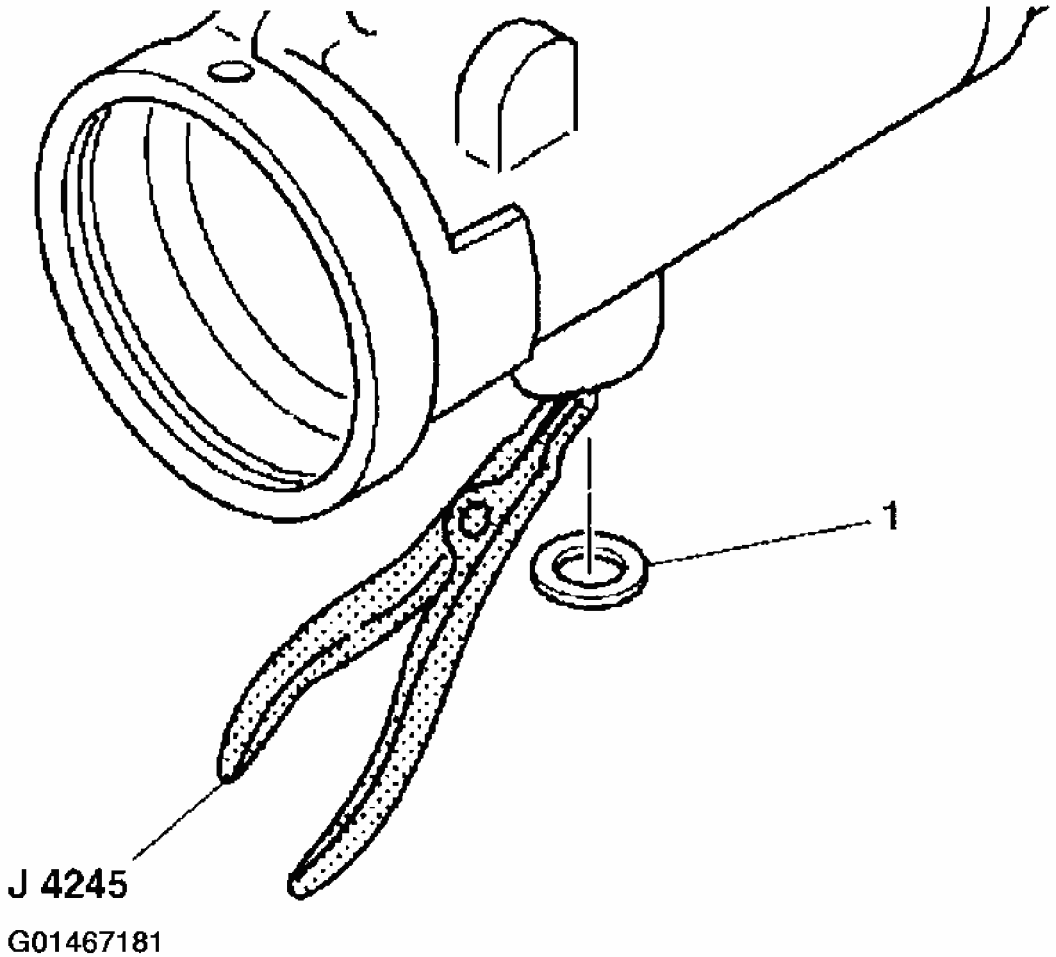

Fig. 65: Removing Snap Ring Using Internal Snap Ring Pliers
Courtesy of GENERAL MOTORS CORP.

7. Remove the following components from the power steering gear (1):
   - The dust seal (5)
   - The return ring (4)
   - The washer (3)
   - The pitman shaft oil seal (2)
8. Inspect the pitman shaft seal surfaces for roughness or pitting.

   Replace the pitman shaft if the shaft is pitted.

9. Clean the pitman shaft and seal areas using a wire brush.

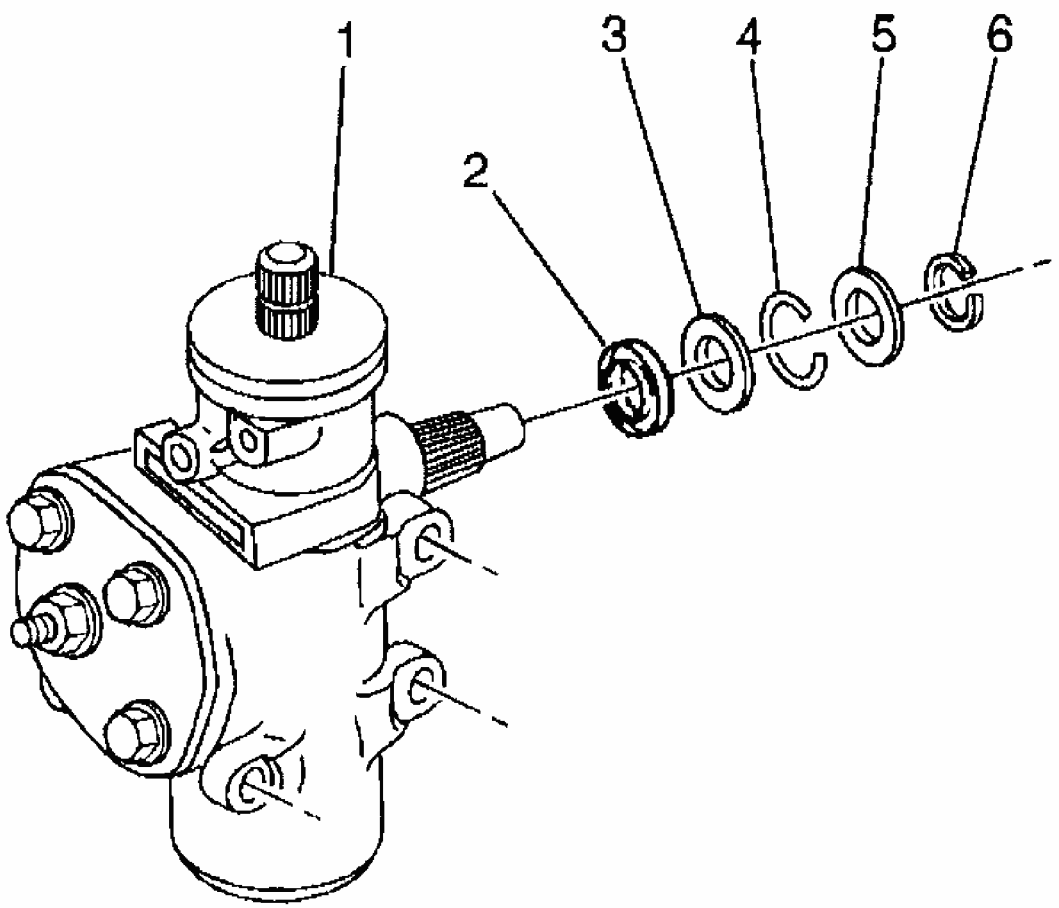

Fig. 66: Removing Dust Seal, Return Ring, Washer & Pitman Shaft Oil Seal From Power Steering Gear

Courtesy of GENERAL MOTORS CORP.

Installation Procedure

1. Lubricate the new seals with grease.
2. Apply a single layer of tape to the pitman arm shaft in order to avoid damaging the seals.
3. Install the pitman shaft oil seal (2) and washer (3) to power steering gear.

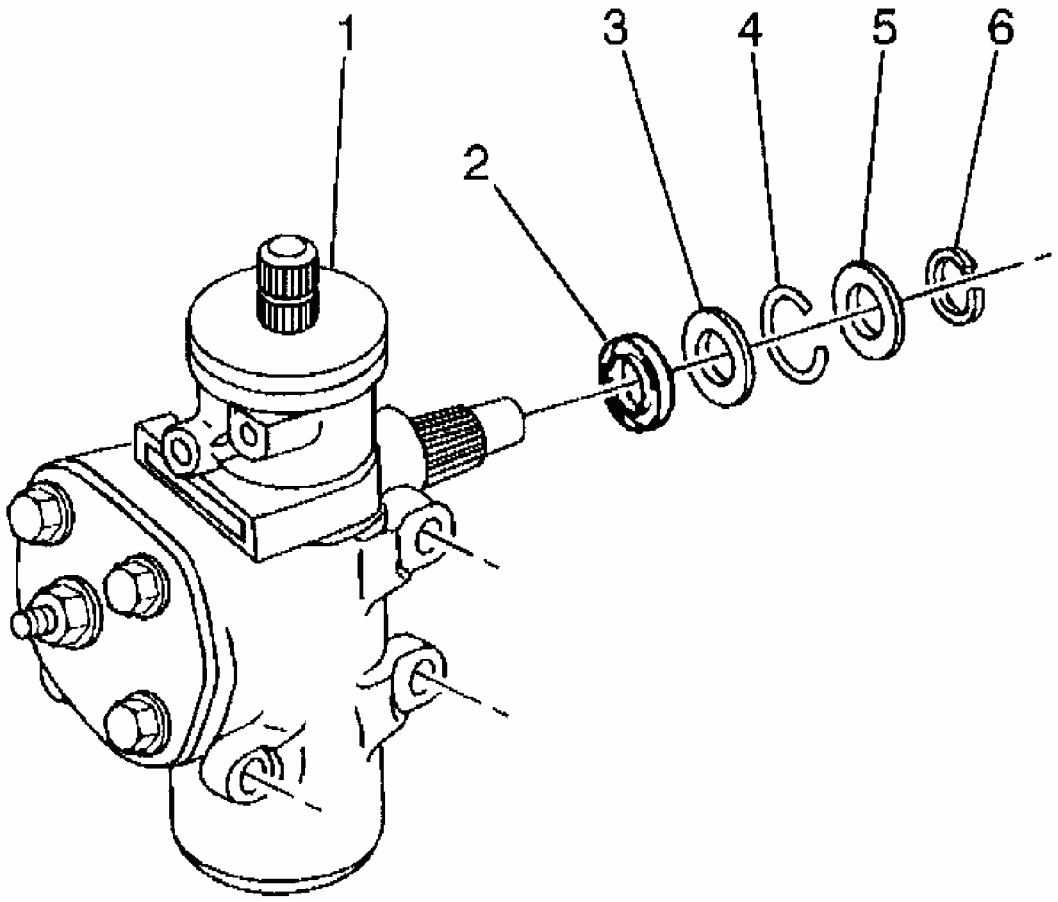

Fig. 67: Installing Pitman Shaft Oil Seal & Washer To Power Steering Gear
Courtesy of GENERAL MOTORS CORP.

4. Use *J 6219* in order to seat the pitman shaft oil seal and the washer into the power steering gear.

   The seal should be in far enough to install the return ring, dust seal, and snap ring.

5. Install the return ring and dust seal to the power steering gear.
6. Use *J 6219* in order to seat the return ring and dust seal into the power steering gear.

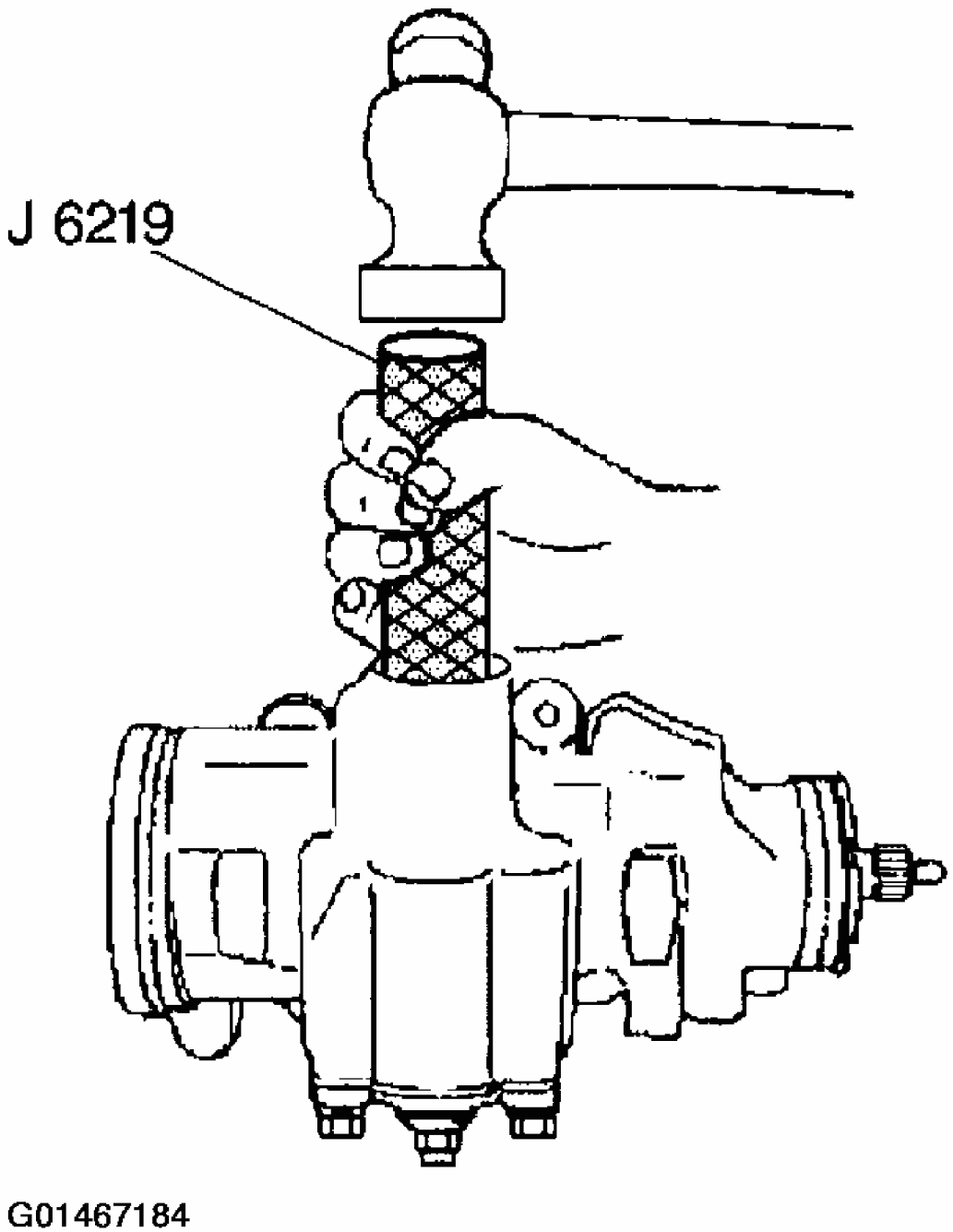

Fig. 68: Installing Return Ring & Dust Seal To Power Steering Gear Using Pitman Shaft Oil Seal Installer
Courtesy of GENERAL MOTORS CORP.

7. Install the snap ring (1) to the pitman arm shaft using *J 4245* .
8. Center the steering gear.
9. Line up steering gear to pitman arm.
10. Install the pitman arm. Refer to **PITMAN ARM REPLACEMENT (RWD)** or **PITMAN ARM REPLACEMENT (4WD)** in Steering Linkage.
11. Bleed the power steering system. Refer to **BLEEDING THE POWER STEERING SYSTEM** .

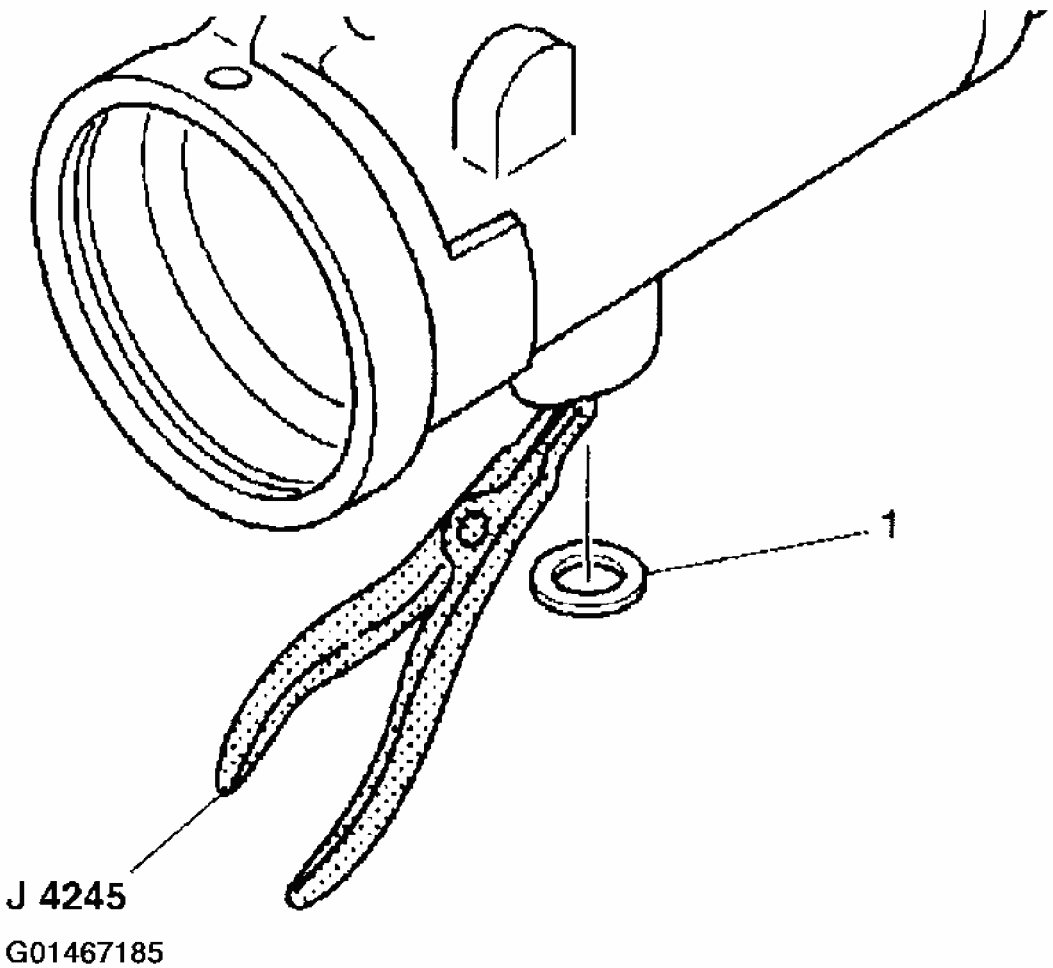

Fig. 69: Installing Snap Ring To Pitman Arm Shaft Using Internal Snap Ring Pliers
Courtesy of GENERAL MOTORS CORP.

PITMAN SHAFT SEAL REPLACEMENT - ON VEHICLE (4WD)

Tools Required

- *J 4245* Internal Snap Ring Pliers

- *J 6219* Pitman Shaft Oil Seal Installer

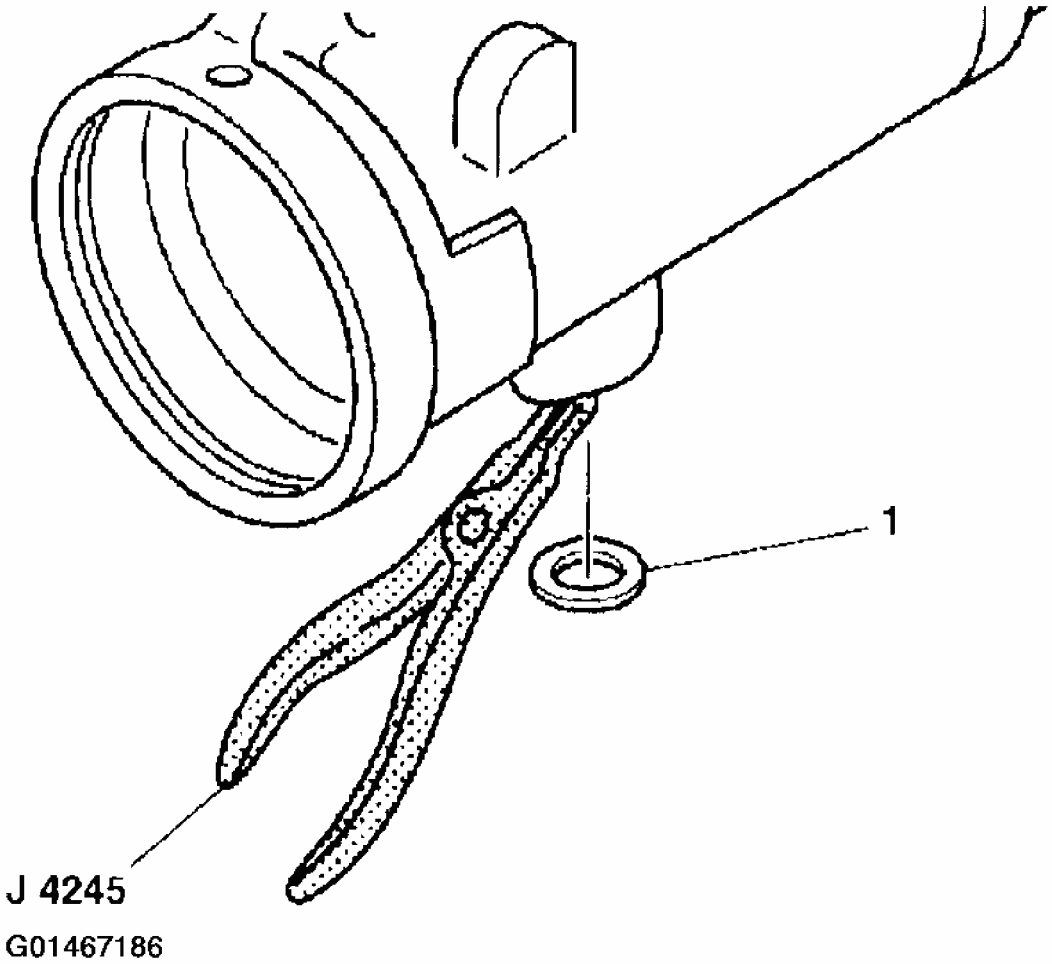

Fig. 70: Removing Snap Ring Using Internal Snap Ring Pliers (4WD)
Courtesy of GENERAL MOTORS CORP.

Removal Procedure

1. Remove the pitman arm. Refer to **PITMAN ARM REPLACEMENT (RWD)** or **PITMAN ARM REPLACEMENT (4WD)** .
2. Remove the snap ring (1) using *J 4245* .

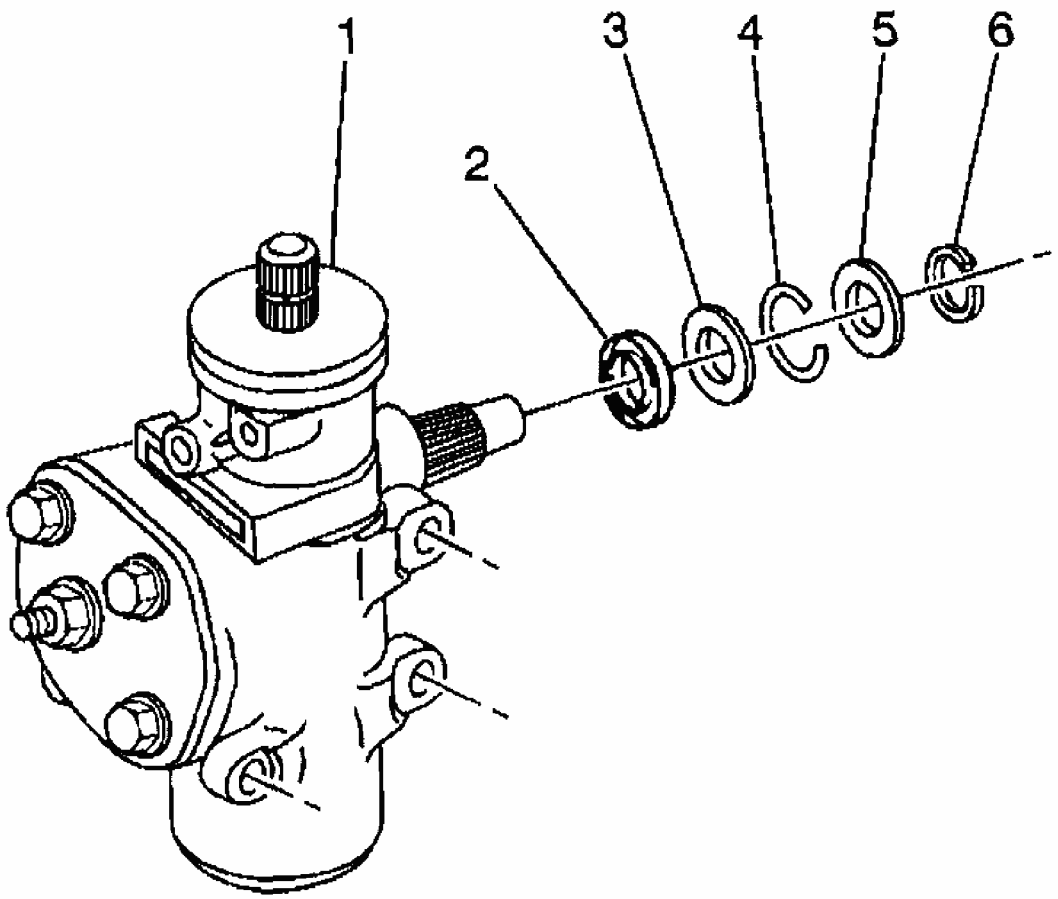

Fig. 71: Removing Dust Seal, Return Ring, Washer & Pitman Shaft Oil Seal From Power Steering Gear
Courtesy of GENERAL MOTORS CORP.

3. Remove the following components from the power steering gear (1):
   - The dust seal (5)
   - The return ring (4)
   - The washer (3)
   - The pitman shaft oil seal (2)
4. Inspect the pitman shaft seal surfaces for roughness or pitting.

   Replace the pitman shaft if the shaft is pitted.

5. Clean the pitman shaft and seal areas using a wire brush.

Installation Procedure

1. Lubricate the new seals with grease.
2. Apply a single layer of tape to the pitman arm shaft in order to avoid damaging the seals.
3. Install the pitman shaft oil seal (2) and washer (3) to power steering gear.

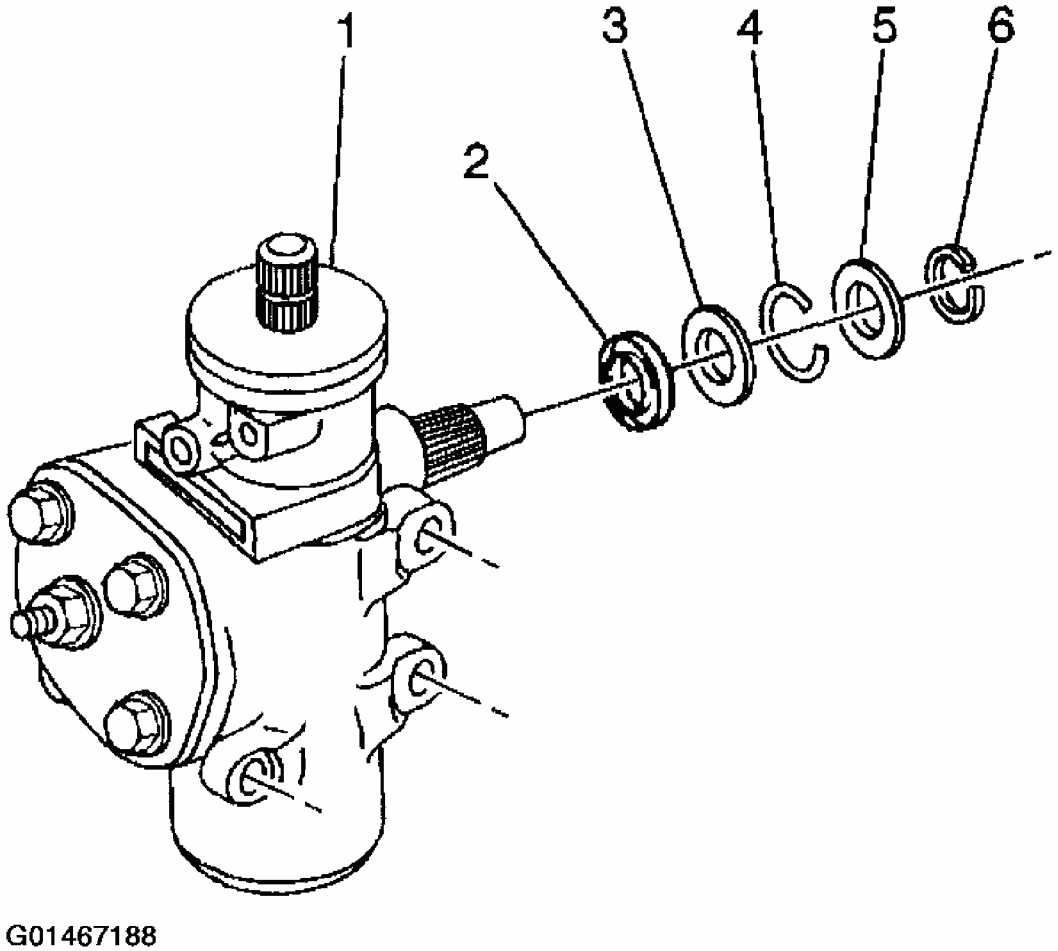

Fig. 72: Installing Pitman Shaft Oil Seal & Washer To Power Steering Gear
Courtesy of GENERAL MOTORS CORP.

4. Use *J 6219* in order to seat the pitman shaft oil seal and the washer into the power steering gear.

   The seal should be in far enough to install the return, dust seal, and snap ring.

5. Install the return ring and dust seal to the power steering gear.
6. Use *J 6219* in order to seat the return ring and dust seal into the power steering gear.

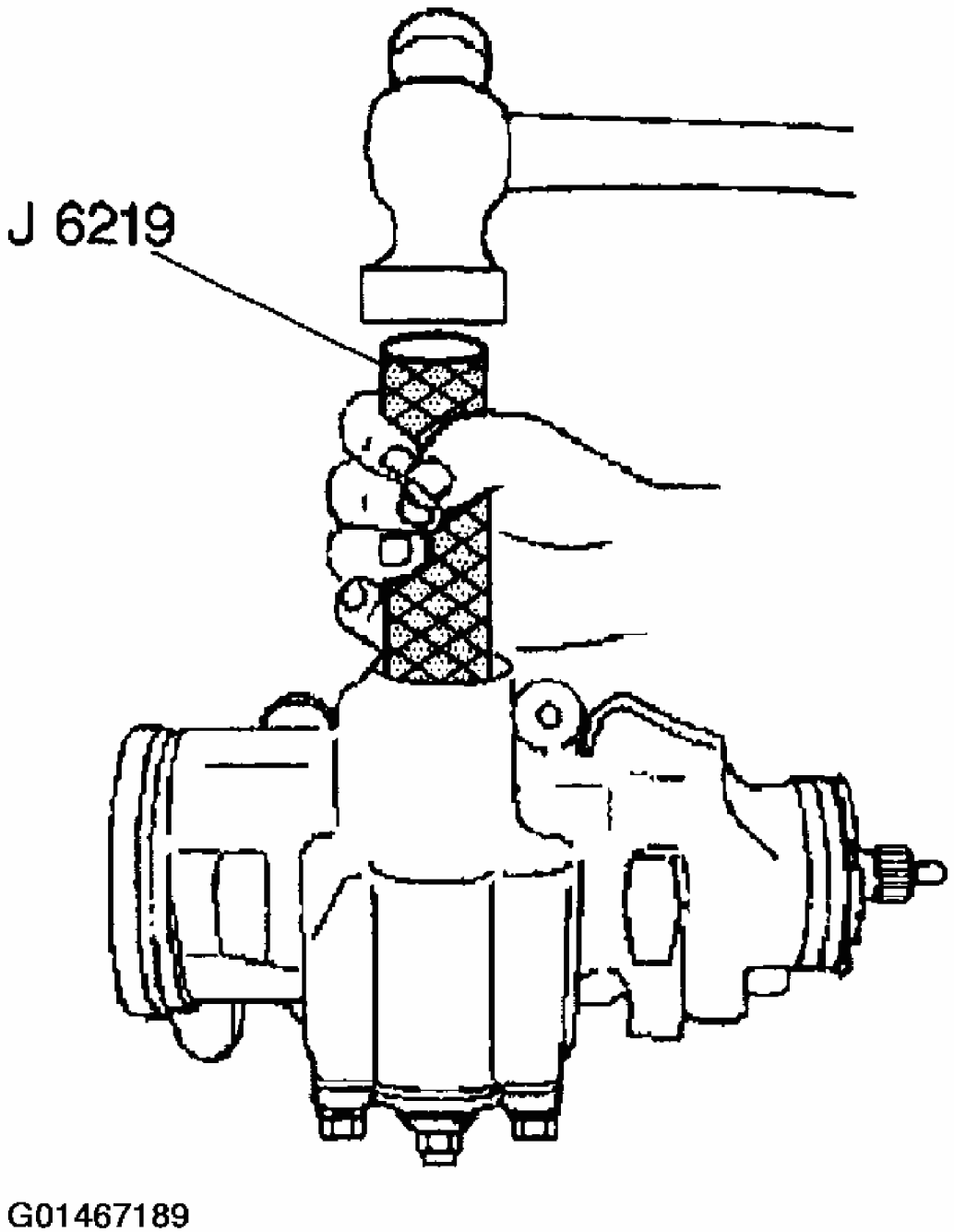

Fig. 73: Installing Return Ring & Dust Seal Into Power Steering Gear
Courtesy of GENERAL MOTORS CORP.

7. Install the snap ring (1) to the pitman arm shaft using *J 4245* .
8. Install the pitman arm. Refer to **PITMAN ARM REPLACEMENT (RWD)** or **PITMAN ARM REPLACEMENT (4WD)** .

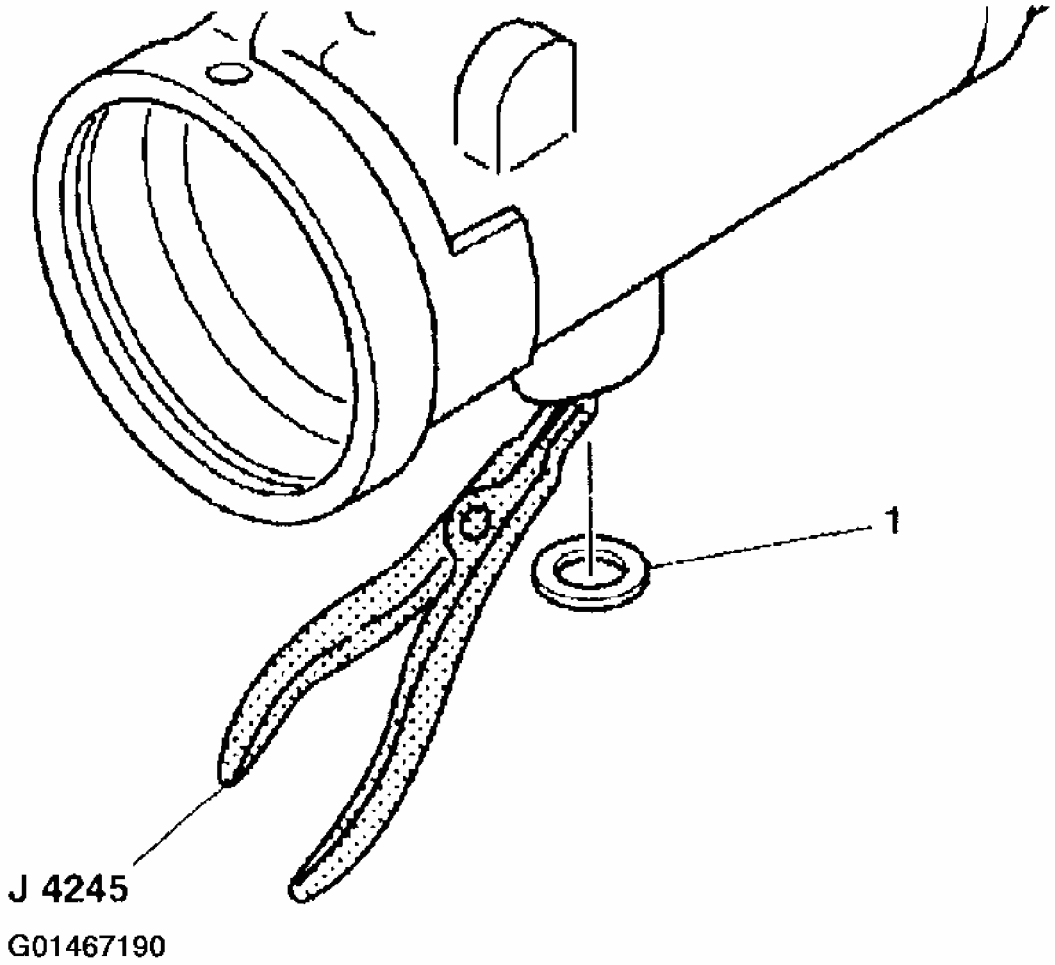

Fig. 74: Installing Snap Ring To Pitman Arm Shaft
Courtesy of GENERAL MOTORS CORP.

POWER STEERING COOLER PIPE/HOSE REPLACEMENT (2.2L)

Removal Procedure

NOTE: Refer to POWER STEERING HOSE DISCONNECTED NOTICE in Cautions and Notices.

1. Remove the air cleaner assembly.
2. Install a drain pan under the vehicle.
3. Disconnect the power steering cooler hose from the power steering pump.

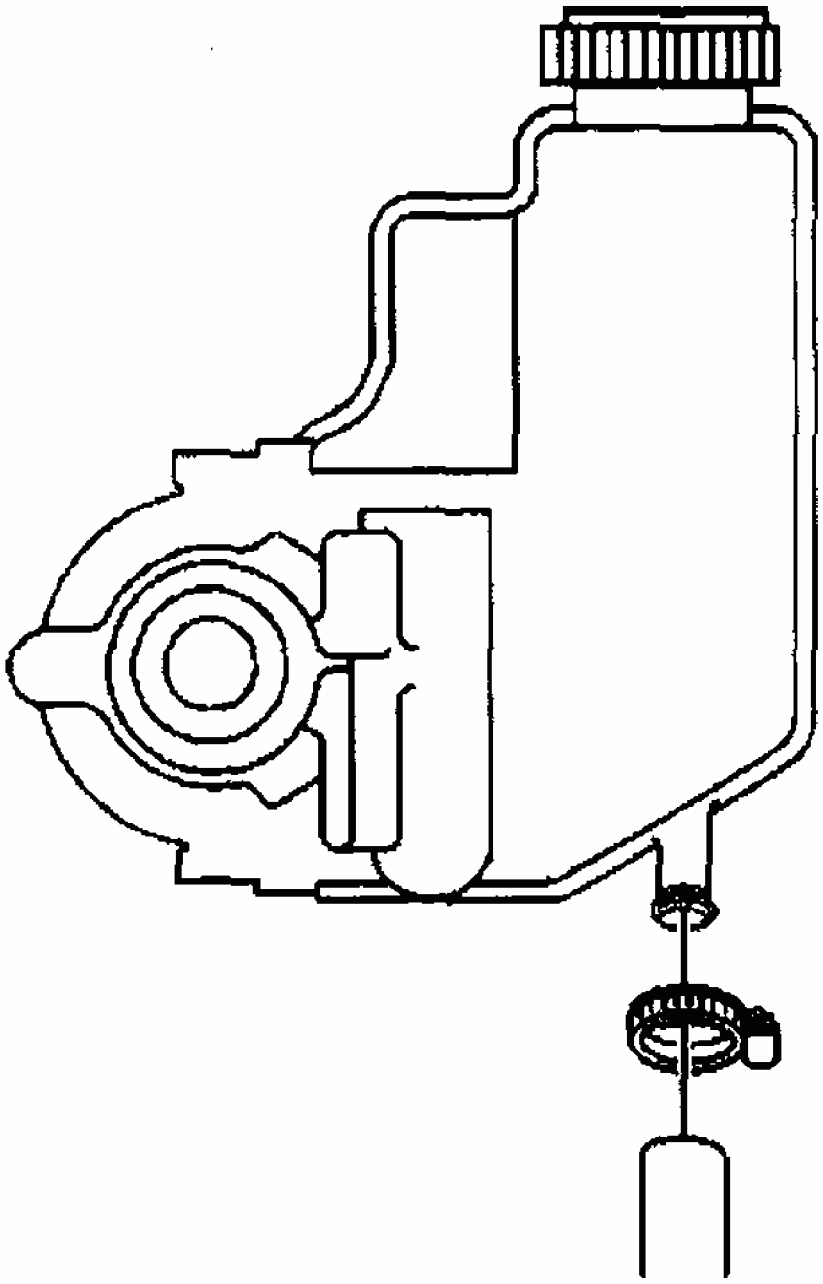

Fig. 75: Disconnecting Power Steering Cooler Hose From Power Steering Pump
Courtesy of GENERAL MOTORS CORP.

4. Disconnect the power steering cooler hose from the power steering cooler.
5. Remove the power steering cooler hose from the vehicle.

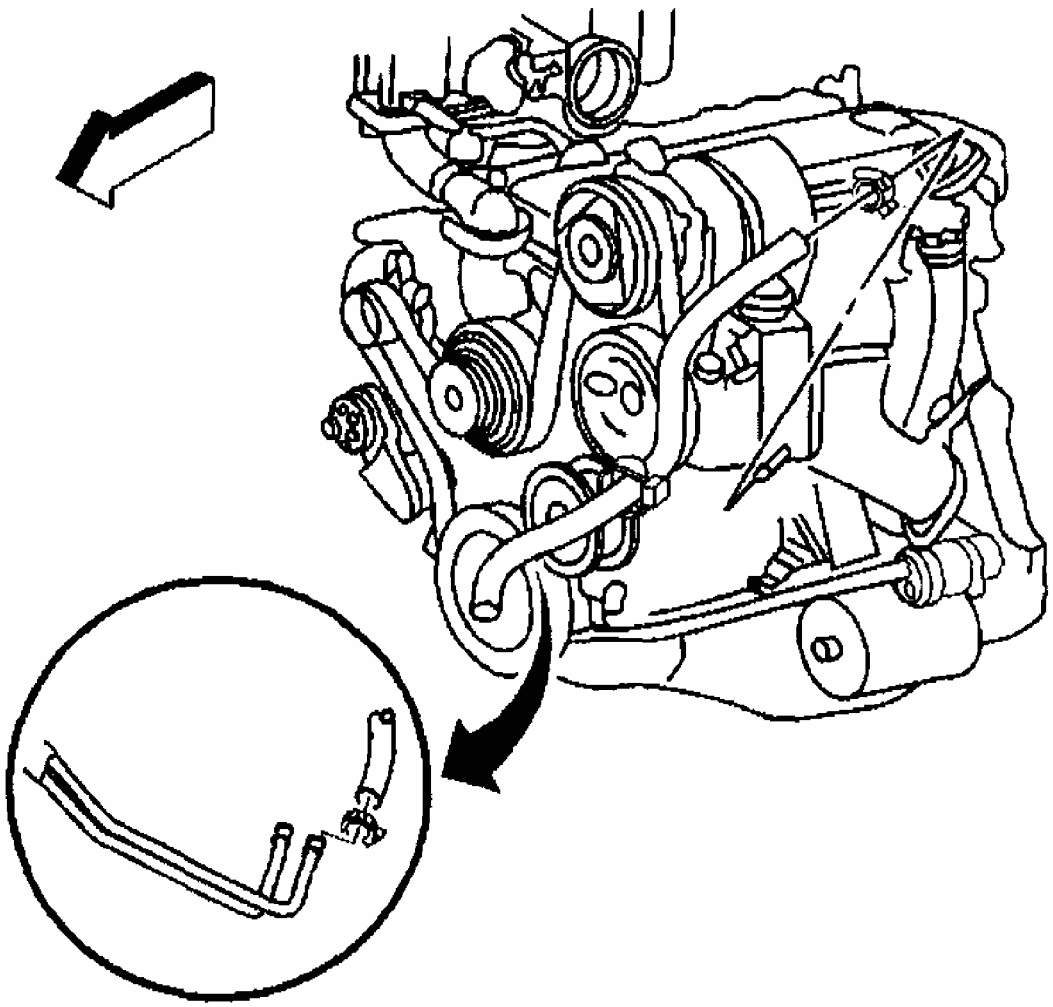

Fig. 76: Removing Power Steering Cooler Hose From Vehicle
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

NOTE: Refer to INSTALLING HOSES WITHOUT TWISTS OR BENDS NOTICE in Cautions and Notices.

1. Install the power steering cooler hose to the vehicle.

NOTE: Refer to FASTENER NOTICE in Cautions and Notices.

2. Connect the power steering cooler hose to the power steering cooler.

Tighten

Tighten the power steering cooler hose to the power steering cooler clamp to 2 N.m (18 lb in).

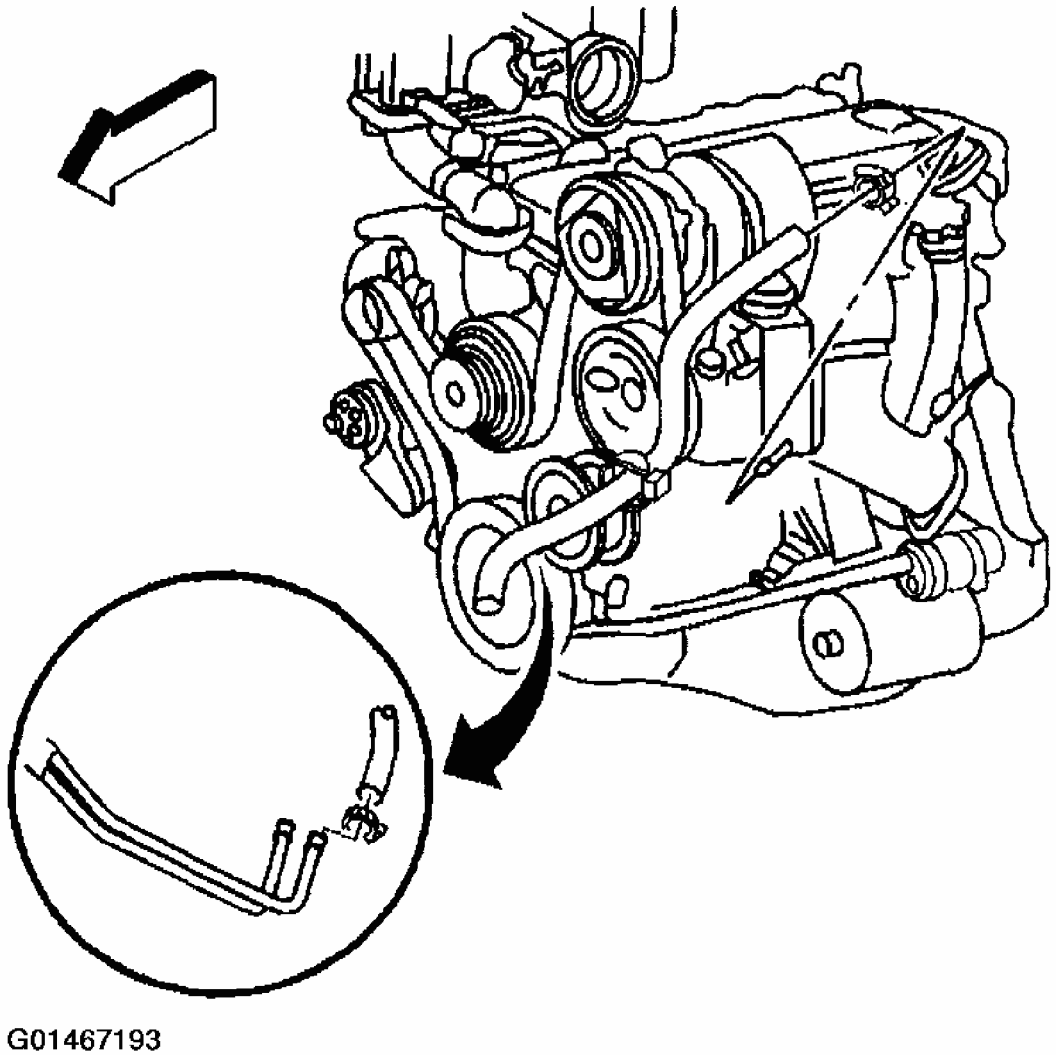

Fig. 77: Installing Power Steering Cooler Hose To Power Steering Cooler
Courtesy of GENERAL MOTORS CORP.

3. Connect the power steering cooler hose to the power steering pump.

Tighten

Tighten the power steering cooler hose to the power steering pump clamp to 2 N.m (18 lb in).

4. Remove the drain pan from under the vehicle.
5. Install the air cleaner assembly.
6. Bleed the power steering system. Refer to **BLEEDING THE POWER STEERING SYSTEM** .

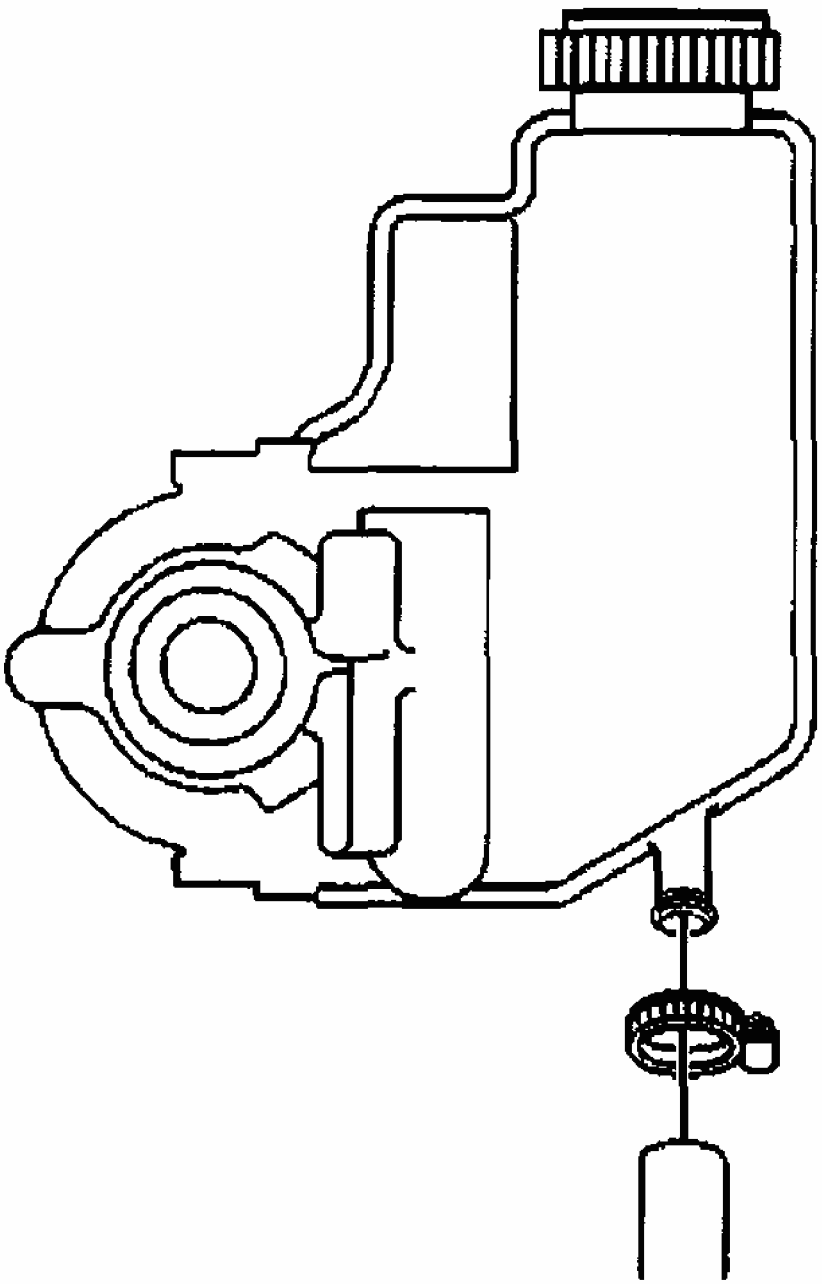

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Fig. 78: Connecting Power Steering Cooler Hose To Power Steering Pump

Courtesy of GENERAL MOTORS CORP.

POWER STEERING COOLER PIPE/HOSE REPLACEMENT (4.3L)

Removal Procedure

NOTE: Refer to POWER STEERING HOSE DISCONNECTED NOTICE in Cautions and Notices.

1. Remove the air cleaner assembly. Refer to AIR CLEANER ASSEMBLY REPLACEMENT in Engine Controls 4.3L.
2. Install a drain pan under the vehicle.
3. Disconnect the power steering cooler hose from the power steering pump.

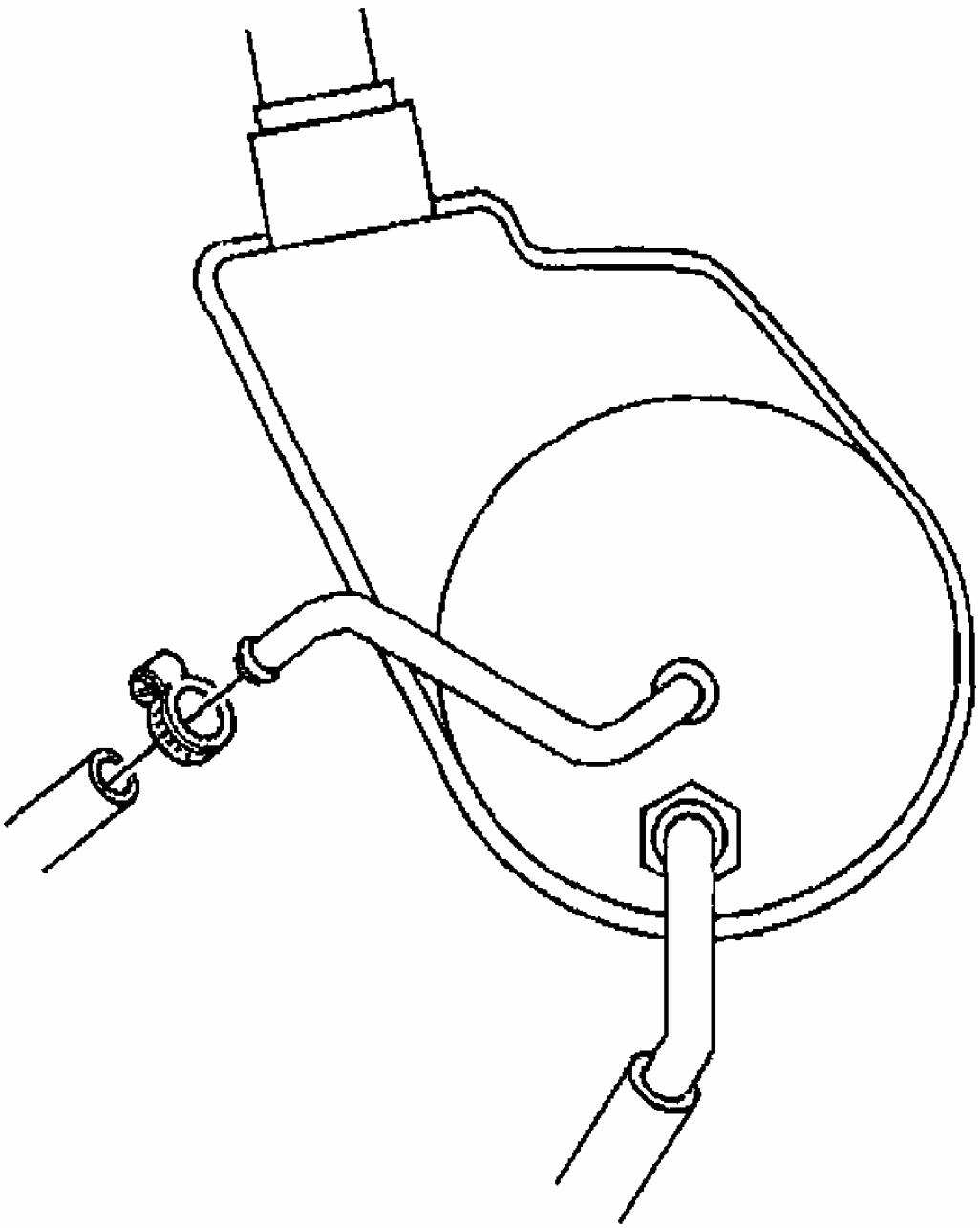
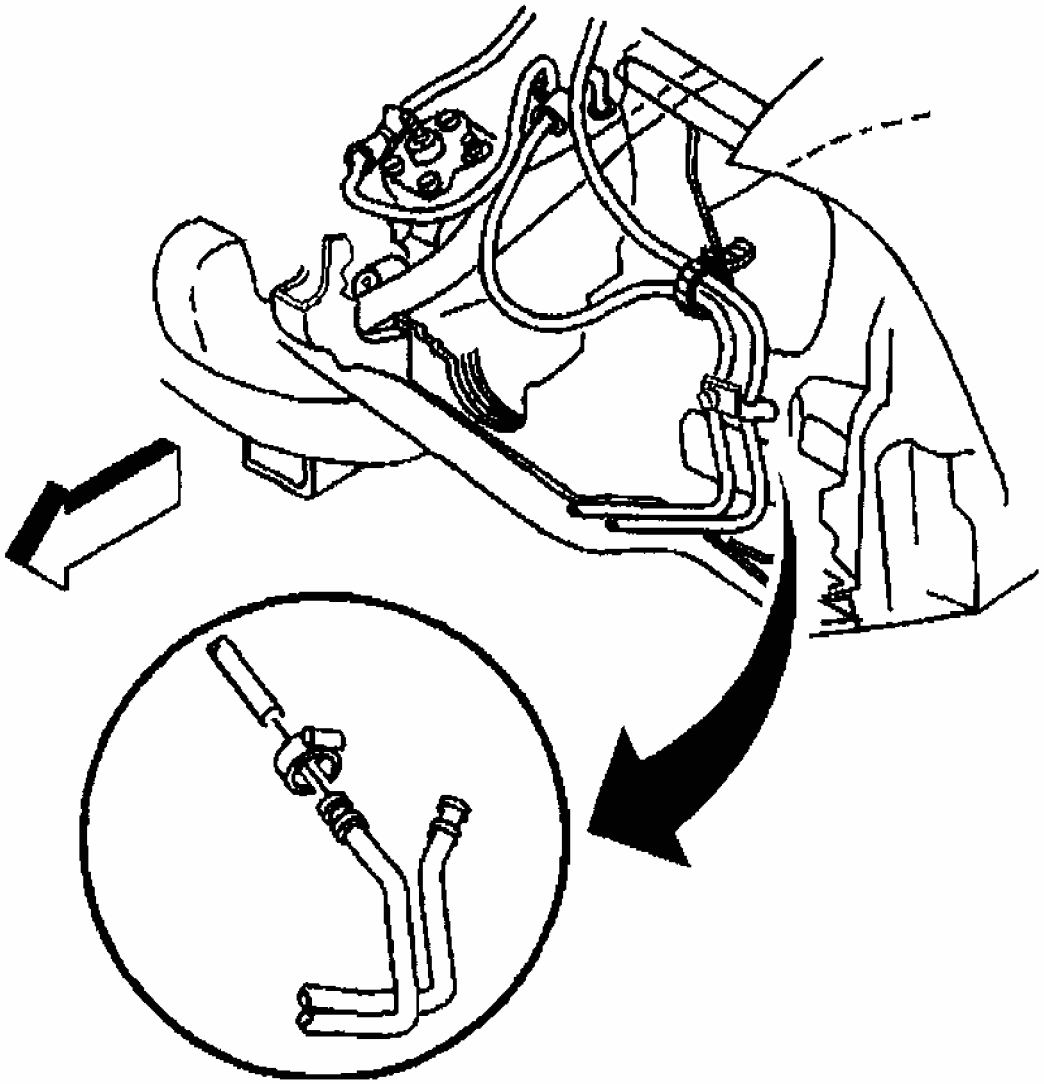


Fig. 79: Disconnecting Power Steering Cooler Hose From Power Steering Pump (4.3L)
Courtesy of GENERAL MOTORS CORP.

4. Disconnect the power steering cooler hose from the power steering cooler.
5. Remove the power steering cooler hose from the vehicle.



G01467196

Fig. 80: Removing Power Steering Cooler Hose From Vehicle
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

NOTE: Refer to INSTALLING HOSES WITHOUT TWISTS OR BENDS NOTICE in Cautions and Notices.

1. Install the power steering cooler hose to the vehicle.

NOTE: Refer to FASTENER NOTICE in Cautions and Notices.

2. Connect the power steering cooler hose to the power steering cooler.

   Tighten

   Tighten the power steering cooler hose to the power steering cooler clamp to 2 N.m (18 lb in).

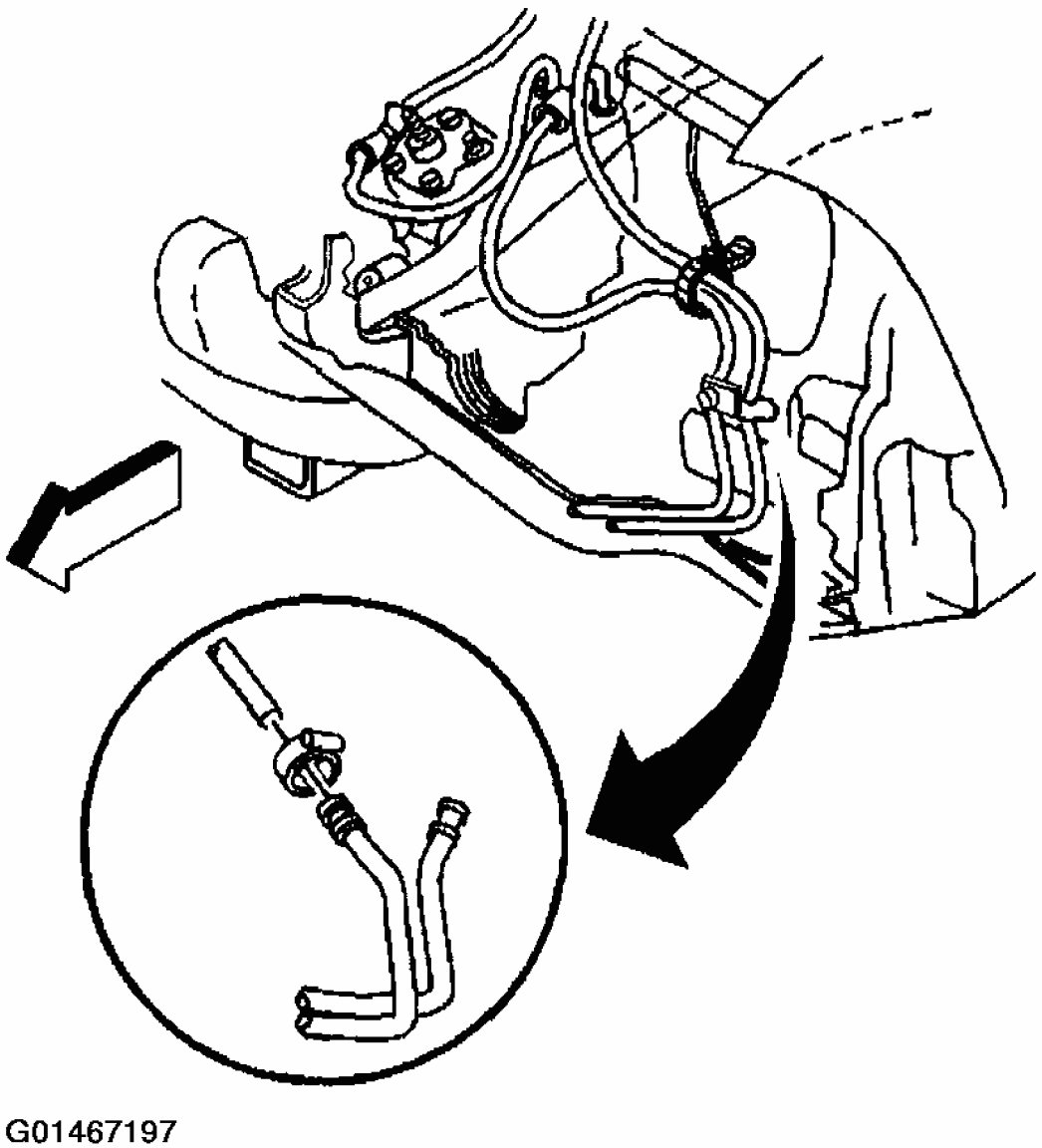


Fig. 81: Installing Power Steering Cooler Hose To Power Steering Cooler
Courtesy of GENERAL MOTORS CORP.

3. Connect the power steering cooler hose to the power steering pump.

Tighten

Tighten the power steering cooler hose to the power steering pump clamp to 2 N.m (18 lb in).

4. Remove the drain pan from under the vehicle.
5. Install the air cleaner assembly. Refer to AIR CLEANER ASSEMBLY REPLACEMENT in Engine Controls 4.3L.
6. Bleed the power steering system. Refer to **BLEEDING THE POWER STEERING SYSTEM** .

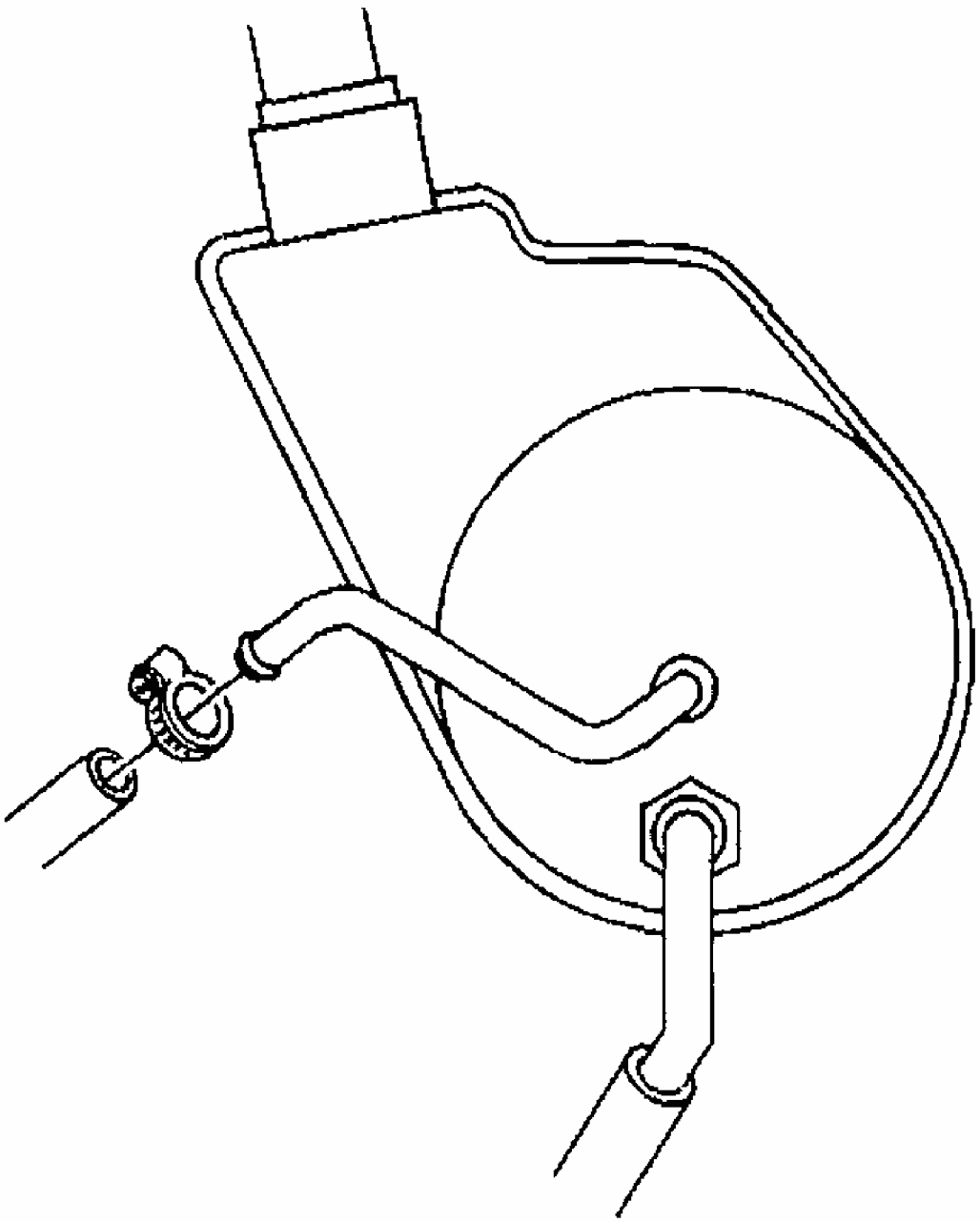


Fig. 82: Tightening Power Steering Cooler Hose To Power Steering Pump Clamp
Courtesy of GENERAL MOTORS CORP.

POWER STEERING COOLER REPLACEMENT (2.2L)

Removal Procedure

NOTE: Refer to POWER STEERING HOSE DISCONNECTED NOTICE in Cautions and Notices.

1. Remove the air cleaner assembly.
2. Install a drain pan under the vehicle.
3. Disconnect the power steering cooler hoses from the power steering cooler.
4. Remove the grille. Refer to **GRILLE REPLACEMENT (GMC)** or **GRILLE REPLACEMENT (CHEVROLET)** in Exterior Trim.

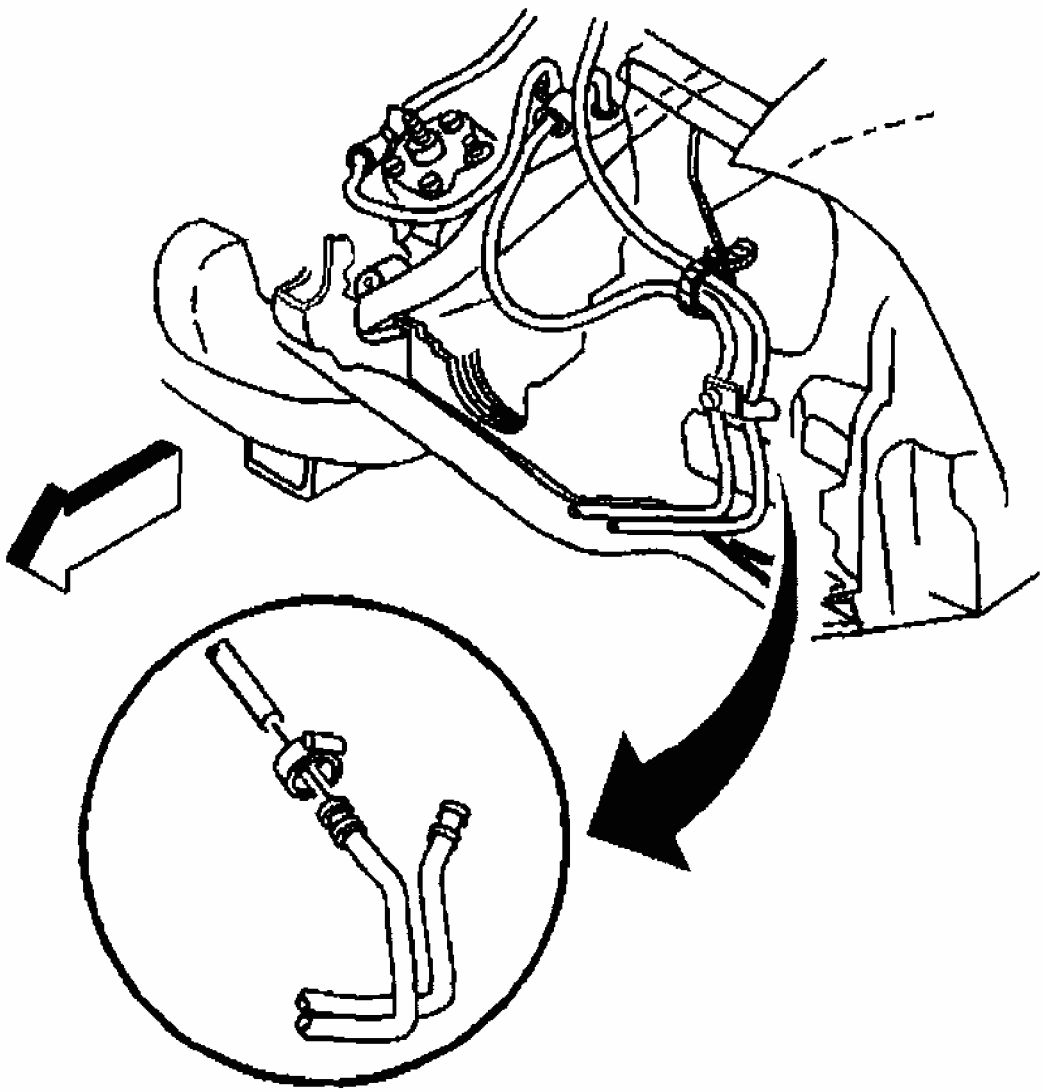


Fig. 83: Disconnecting Power Steering Cooler Hoses From Power Steering Cooler (2.2L)

Courtesy of GENERAL MOTORS CORP.

5. Remove the radiator air intake baffle retaining clips from LH side.
6. Position the radiator air intake baffle out of the way.

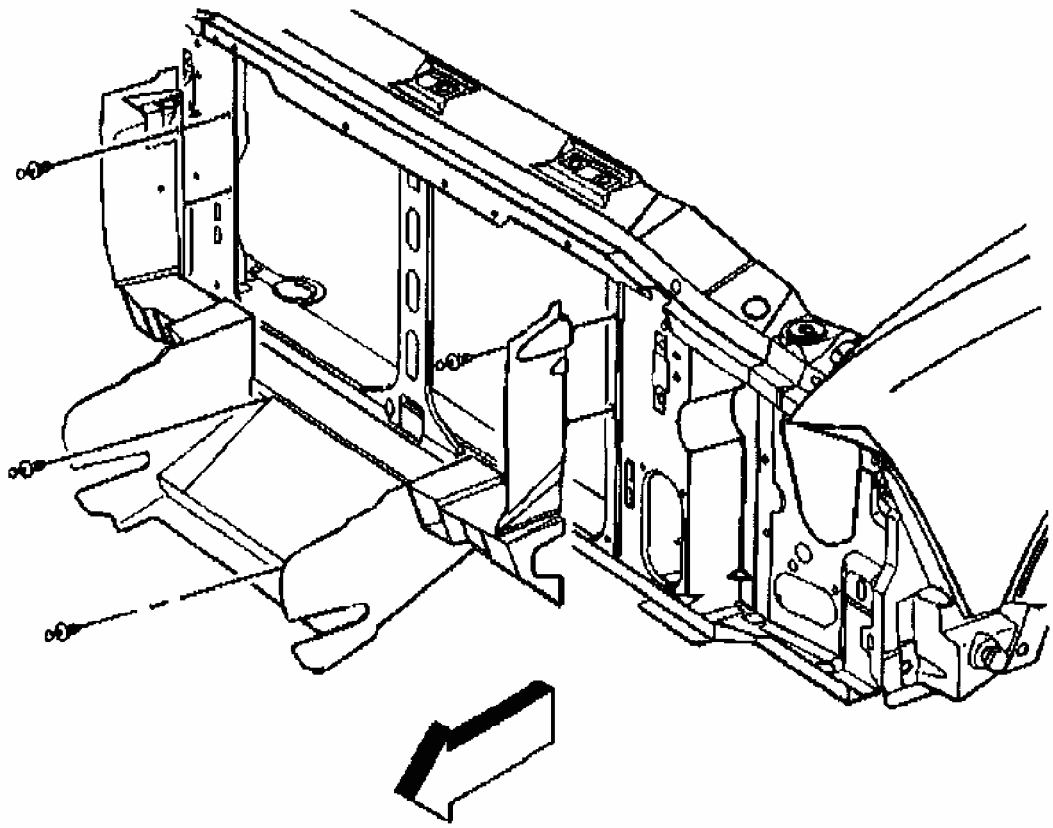


Fig. 84: Removing Radiator Air Intake Baffle Retaining Clips From LH Side
Courtesy of GENERAL MOTORS CORP.

7. Remove the hood latch support mounting bolts.
8. Move the hood latch support forward.

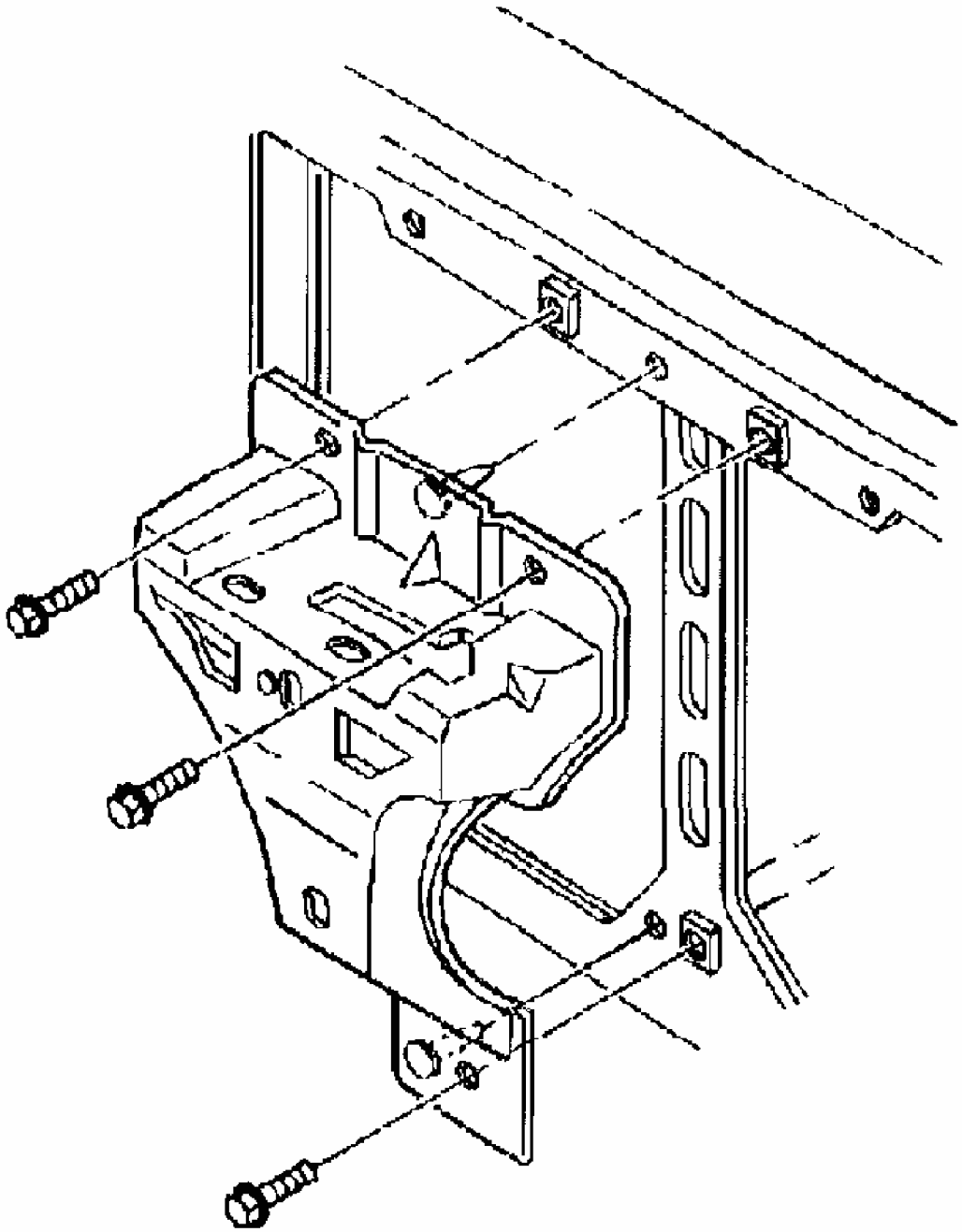


Fig. 85: Hood Latch Support Mounting Bolts
Courtesy of GENERAL MOTORS CORP.

9. Remove the power steering cooler retaining bolts.

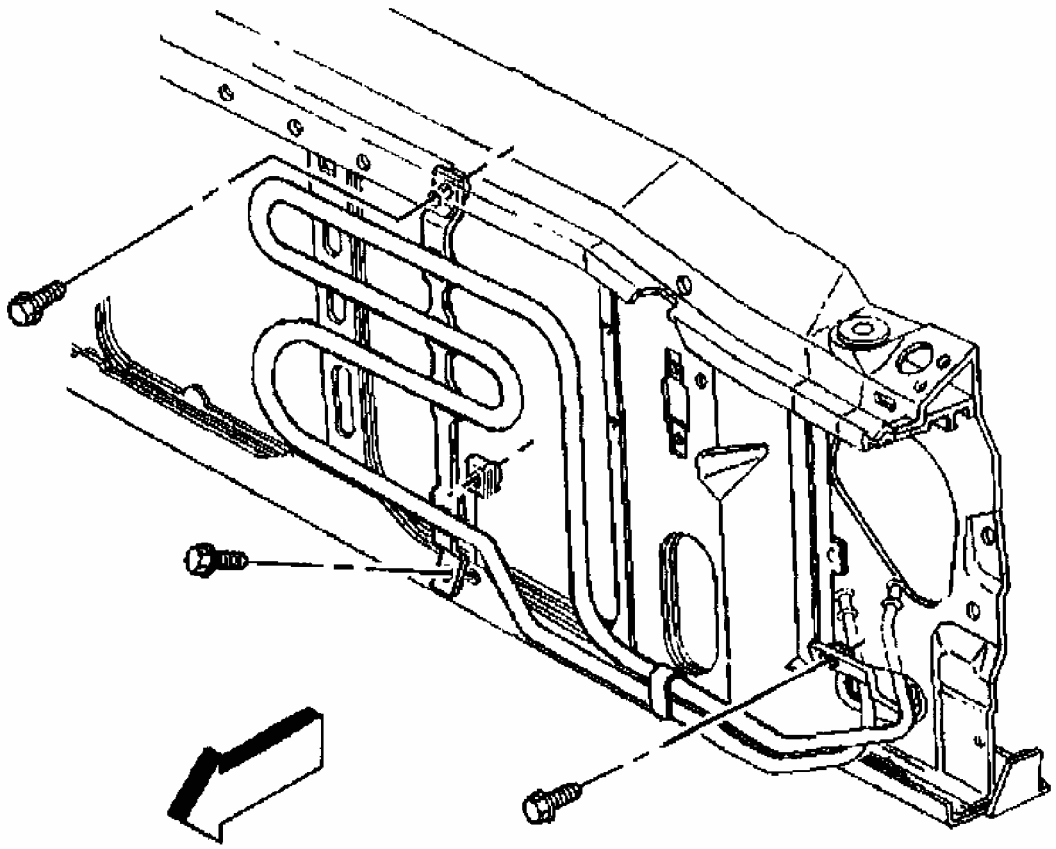


Fig. 86: Power Steering Cooler Retaining Bolts
Courtesy of GENERAL MOTORS CORP.

10. Remove the power steering cooler from the radiator support.

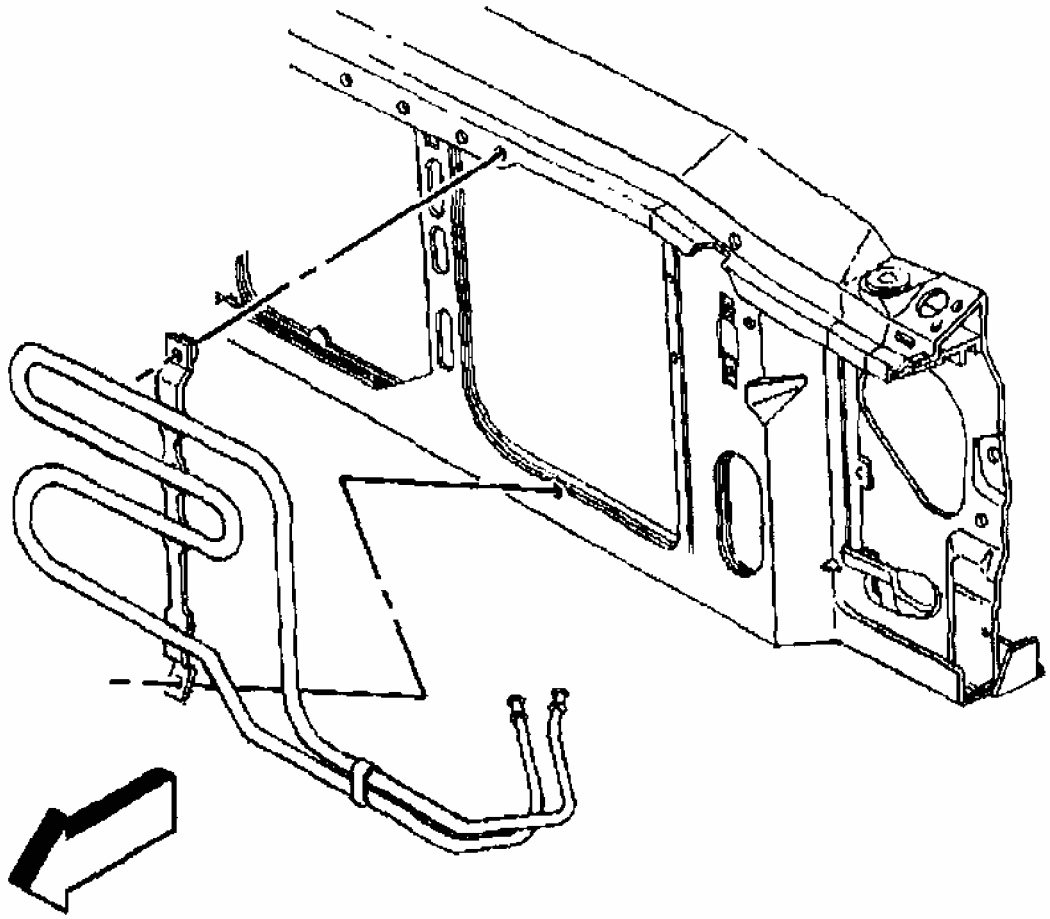


Fig. 87: Removing Power Steering Cooler From Radiator Support
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

NOTE: Refer to INSTALLING HOSES WITHOUT TWISTS OR BENDS NOTICE in Cautions and Notices.

1. Install the power steering cooler to the radiator core support.

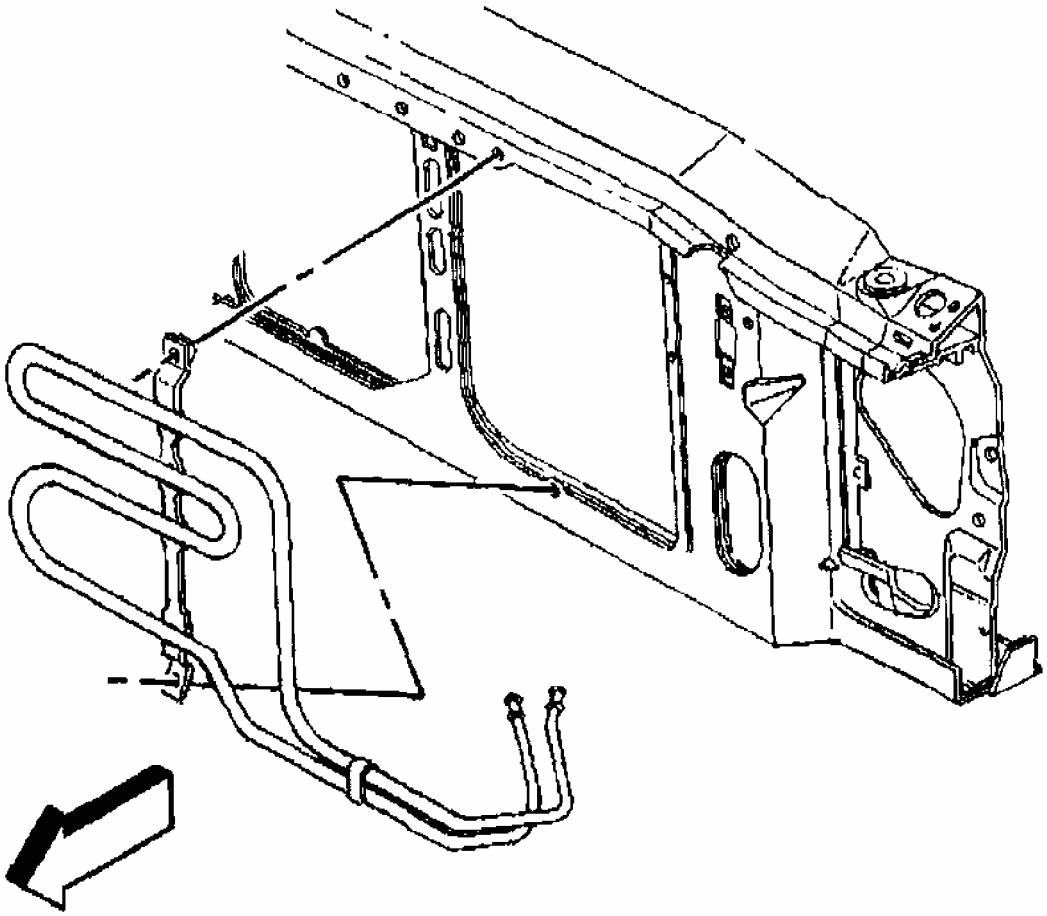


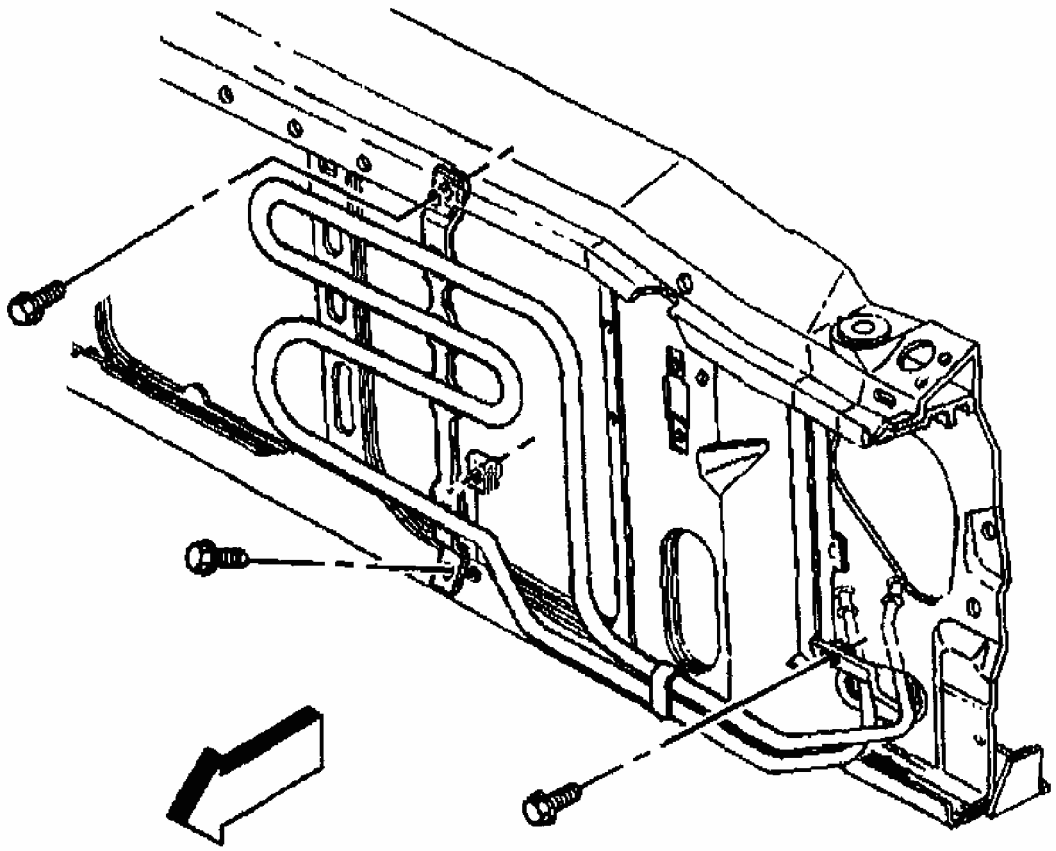
Fig. 88: Installing Power Steering Cooler To Radiator Core Support
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to FASTENER NOTICE in Cautions and Notices.

2. Install the power steering cooler retaining bolts.

Tighten

Tighten the power steering cooler retaining bolts to 10 N.m (7 lb ft).



G01467205

Fig. 89: Power Steering Cooler Retaining Bolts
Courtesy of GENERAL MOTORS CORP.

3. Reposition the hood latch support to the radiator core support.
4. Install the hood latch support mounting bolts.

Tighten

Tighten the hood latch support mounting bolts to 25 N.m (18 lb ft).

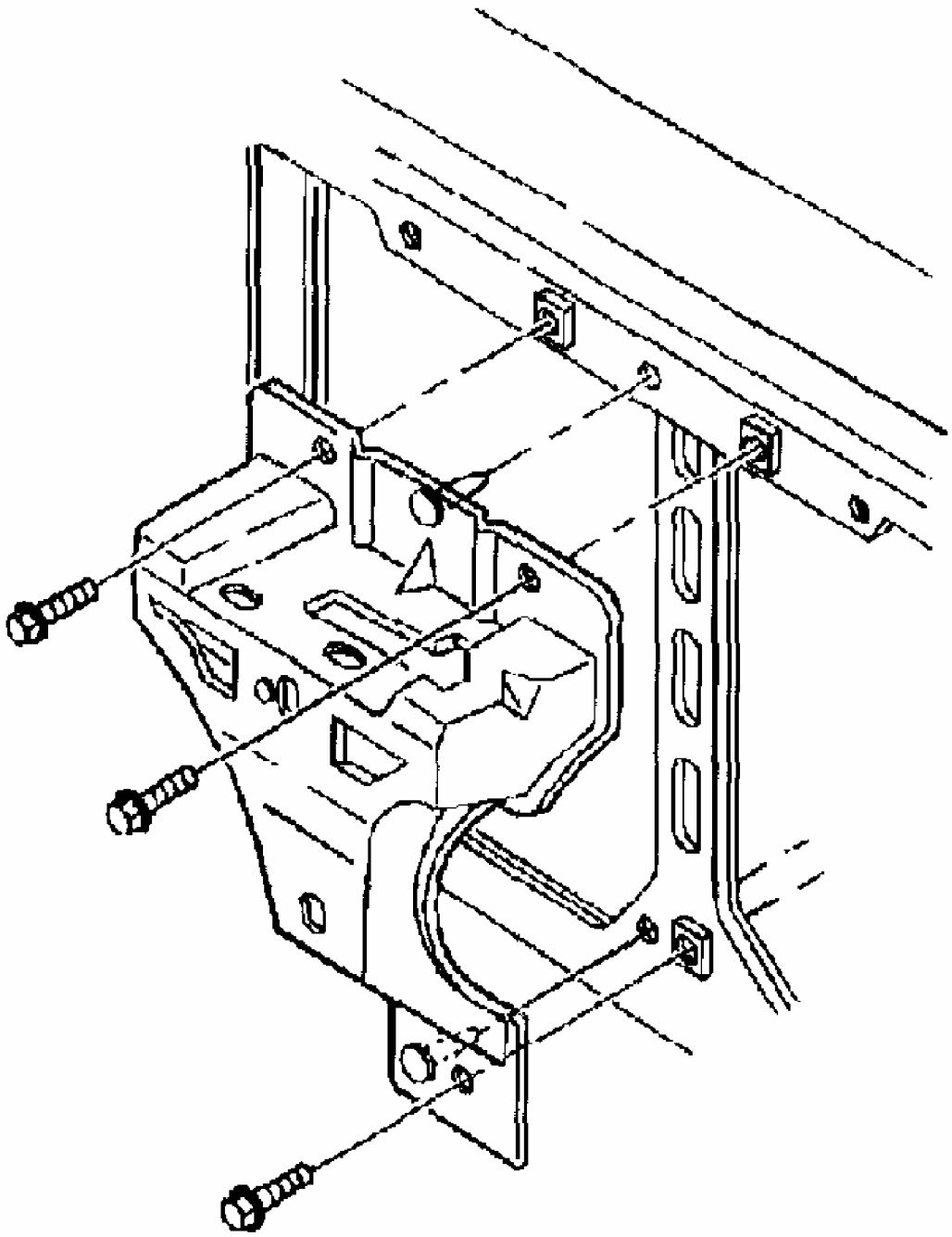
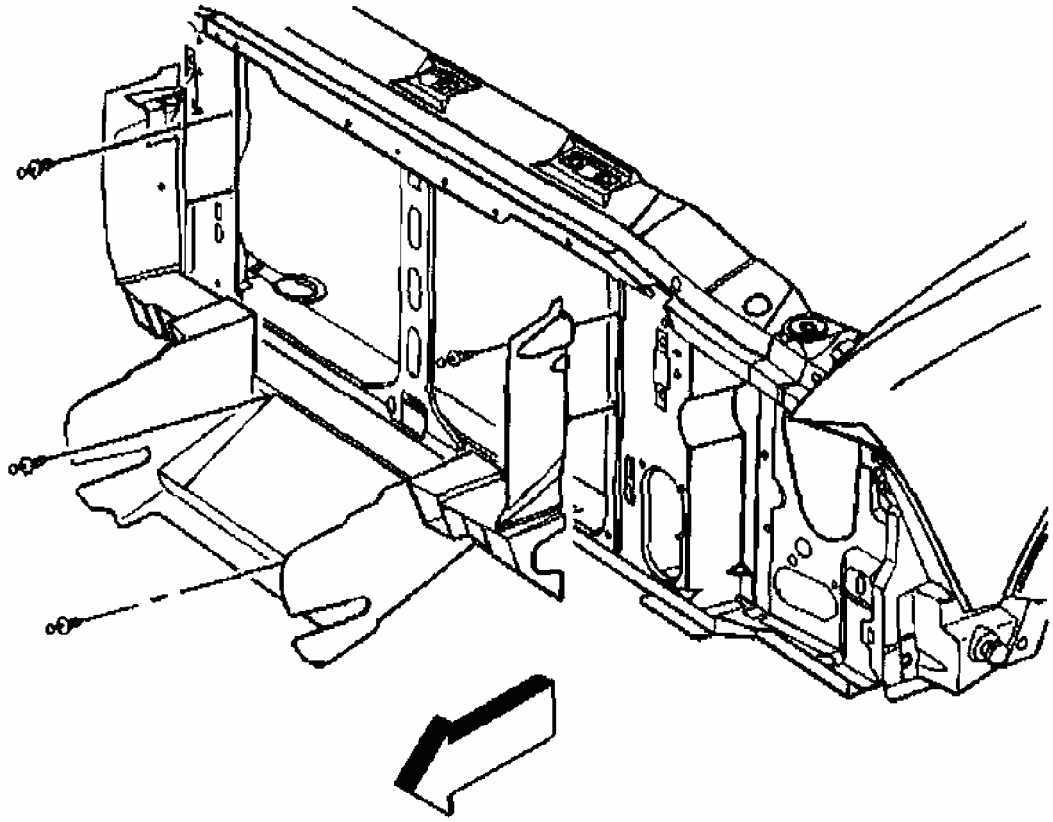


Fig. 90: Hood Latch Support Mounting Bolts
Courtesy of GENERAL MOTORS CORP.

5. Reposition the radiator air intake baffle to the radiator core support.
6. Install the radiator air intake baffle retaining clips to the LH side.

7. Install the grille. Refer to **GRILLE REPLACEMENT (GMC)** or **GRILLE REPLACEMENT (CHEVROLET)** in Exterior Trim.



G01467207

Fig. 91: Installing Radiator Air Intake Baffle Retaining Clips To LH Side
Courtesy of GENERAL MOTORS CORP.

8. Connect the power steering cooler hoses to the power steering cooler.

   Tighten

   Tighten the power steering cooler hose clamps to 2 N.m (18 lb in).

9. Remove the drain pan from under the vehicle.
10. Install the air cleaner assembly.
11. Bleed the power steering system. Refer to **BLEEDING THE POWER STEERING SYSTEM** .

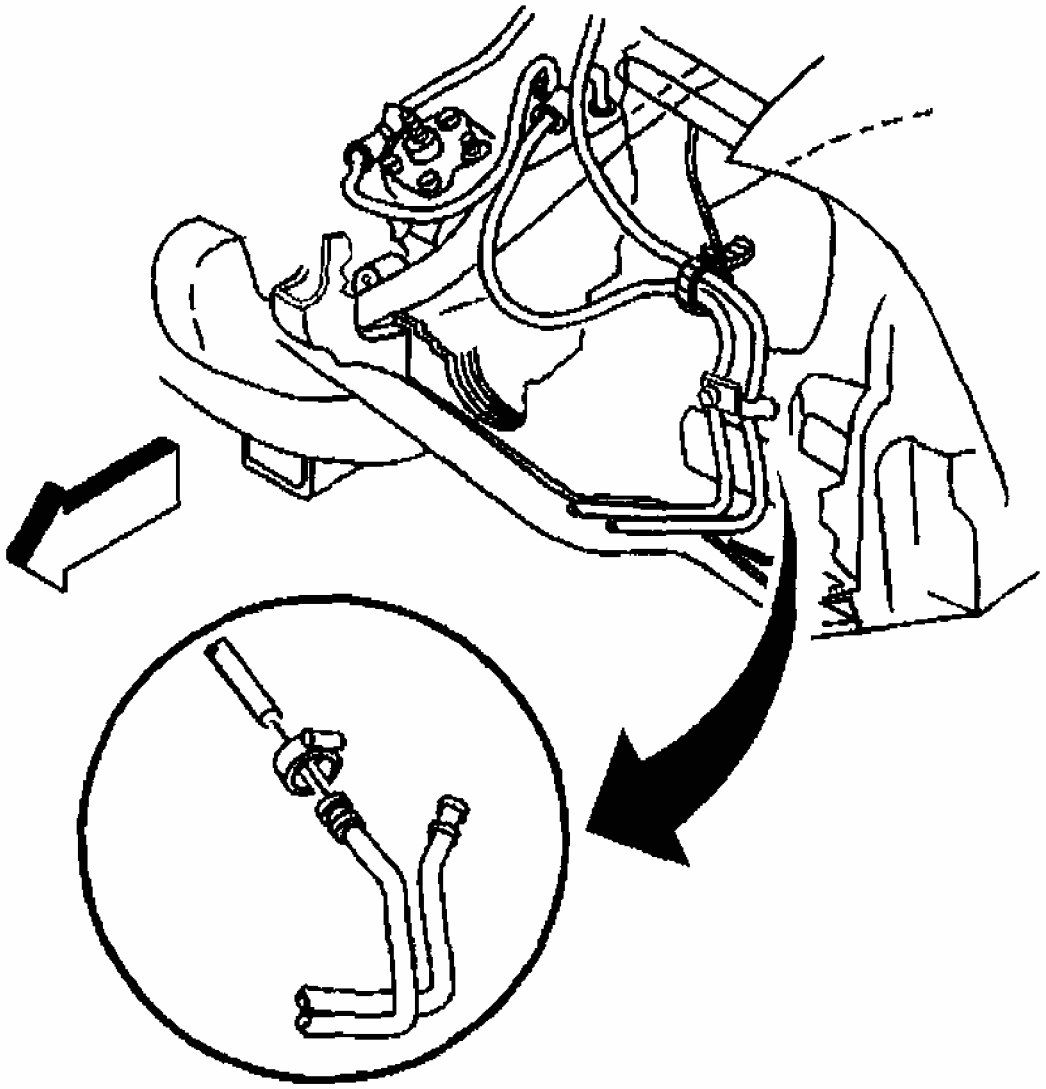


Fig. 92: Connecting Power Steering Cooler Hoses To Power Steering Cooler
Courtesy of GENERAL MOTORS CORP.

POWER STEERING COOLER REPLACEMENT (4.3L)

Removal Procedure

NOTE: Refer to POWER STEERING HOSE DISCONNECTED NOTICE in Cautions and Notices.

1. Remove the air cleaner assembly. Refer to AIR CLEANER ASSEMBLY REPLACEMENT in Engine Controls 4.3L.

2. Install a drain pan under the vehicle.
3. Disconnect the power steering cooler hoses from the power steering cooler.
4. Remove the Grille. Refer to **GRILLE REPLACEMENT (GMC)** or **GRILLE REPLACEMENT (CHEVROLET)** in Exterior Trim.

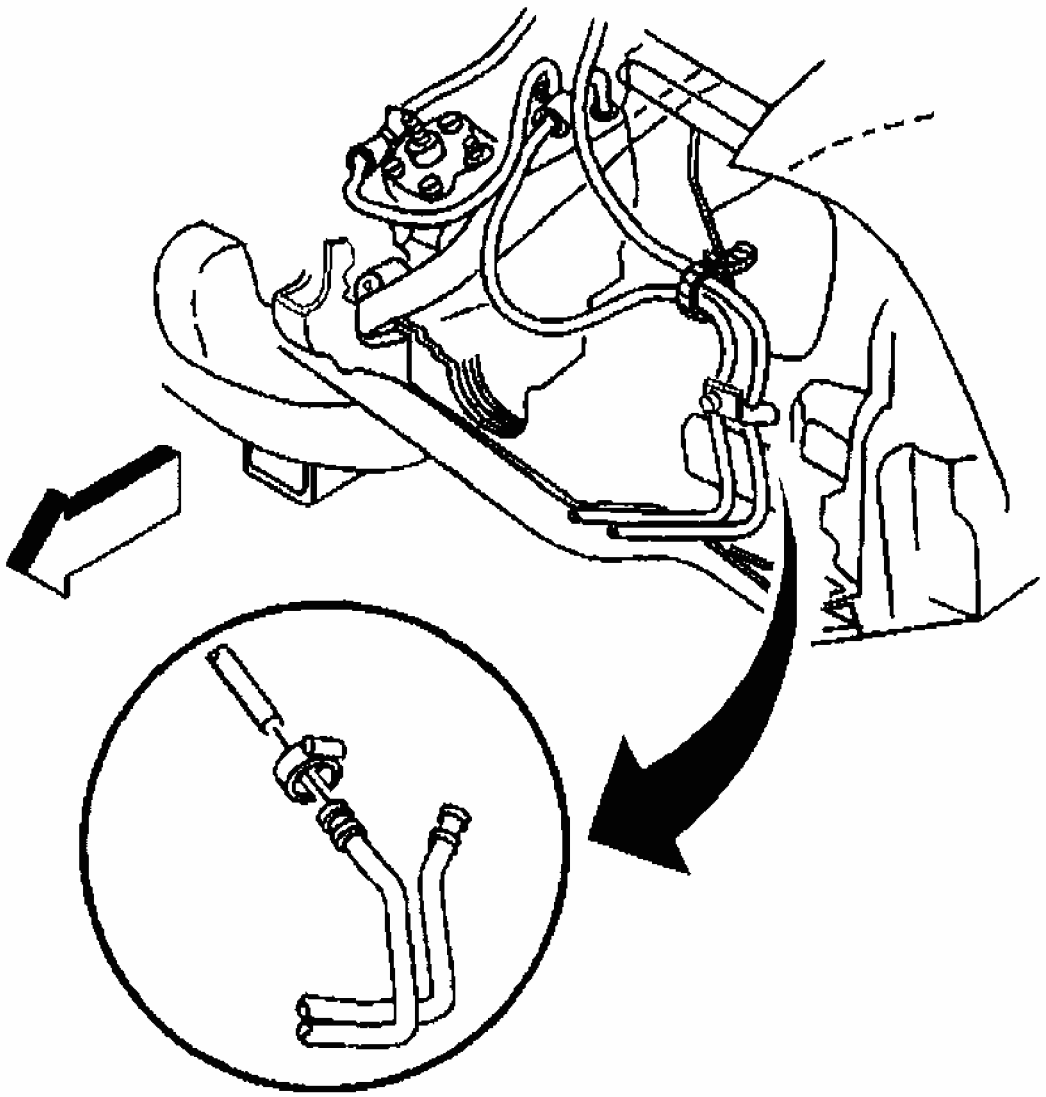


Fig. 93: Disconnecting Power Steering Cooler Hoses From Power Steering Cooler (4.3L)
Courtesy of GENERAL MOTORS CORP.

5. Remove the radiator air intake baffle retaining clips from LH side.
6. Position the radiator air intake baffle out of the way.

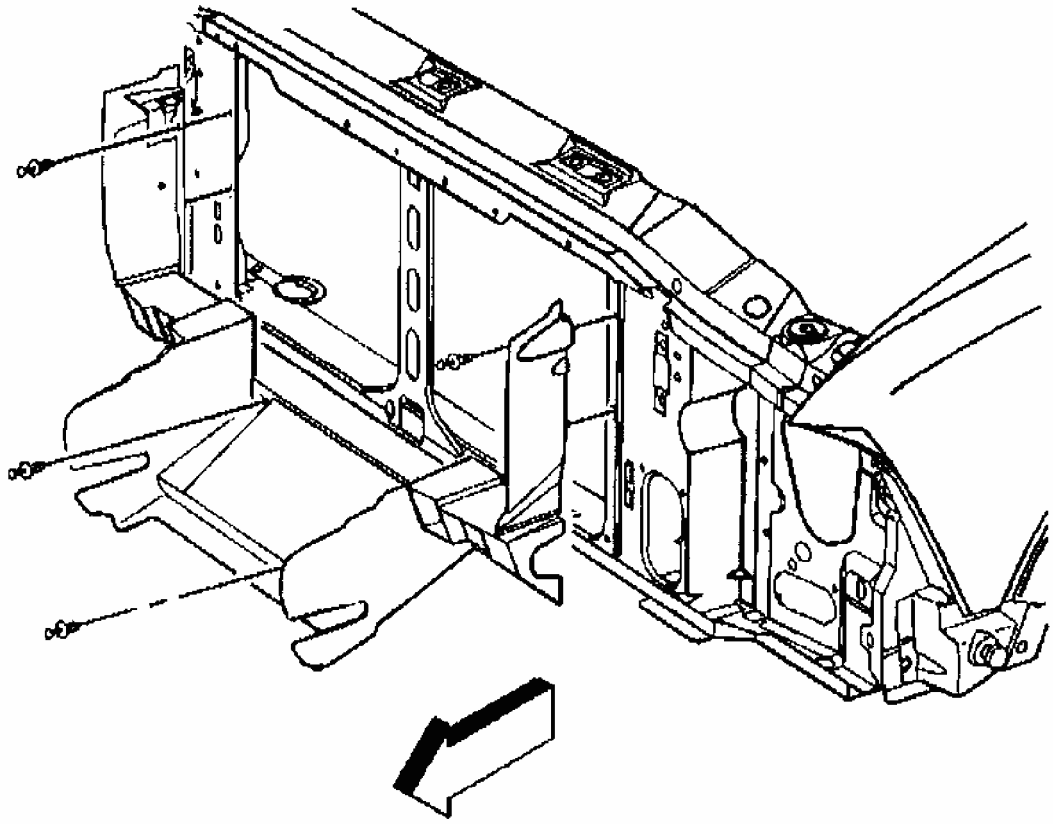
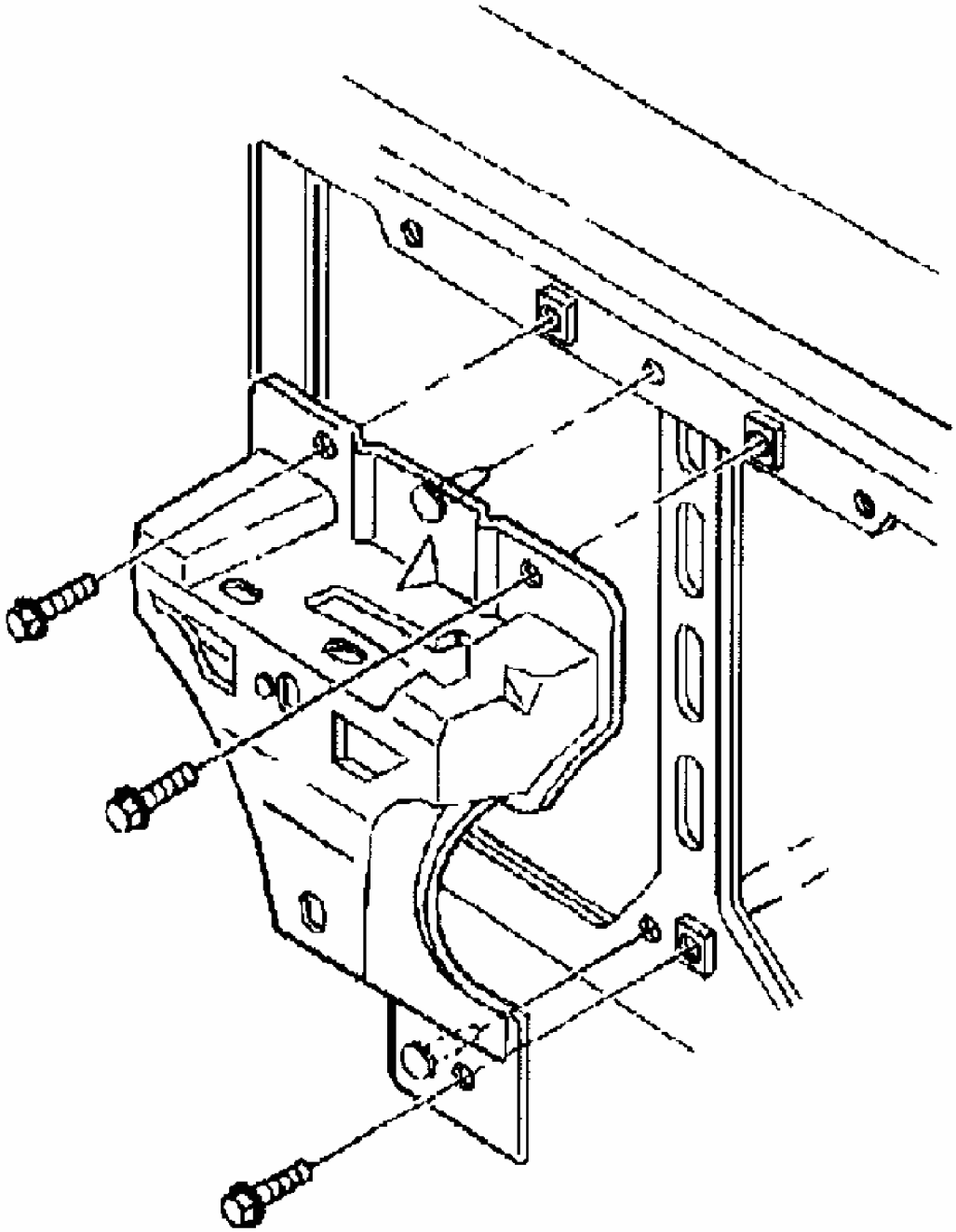


Fig. 94: Removing Radiator Air Intake Baffle Retaining Clips From LH Side
Courtesy of GENERAL MOTORS CORP.

7. Remove the hood latch support mounting bolts.
8. Move the hood latch support forward.



G01467211

Fig. 95: Hood Latch Support Mounting Bolts
Courtesy of GENERAL MOTORS CORP.

9. Remove the power steering cooler retaining bolts.

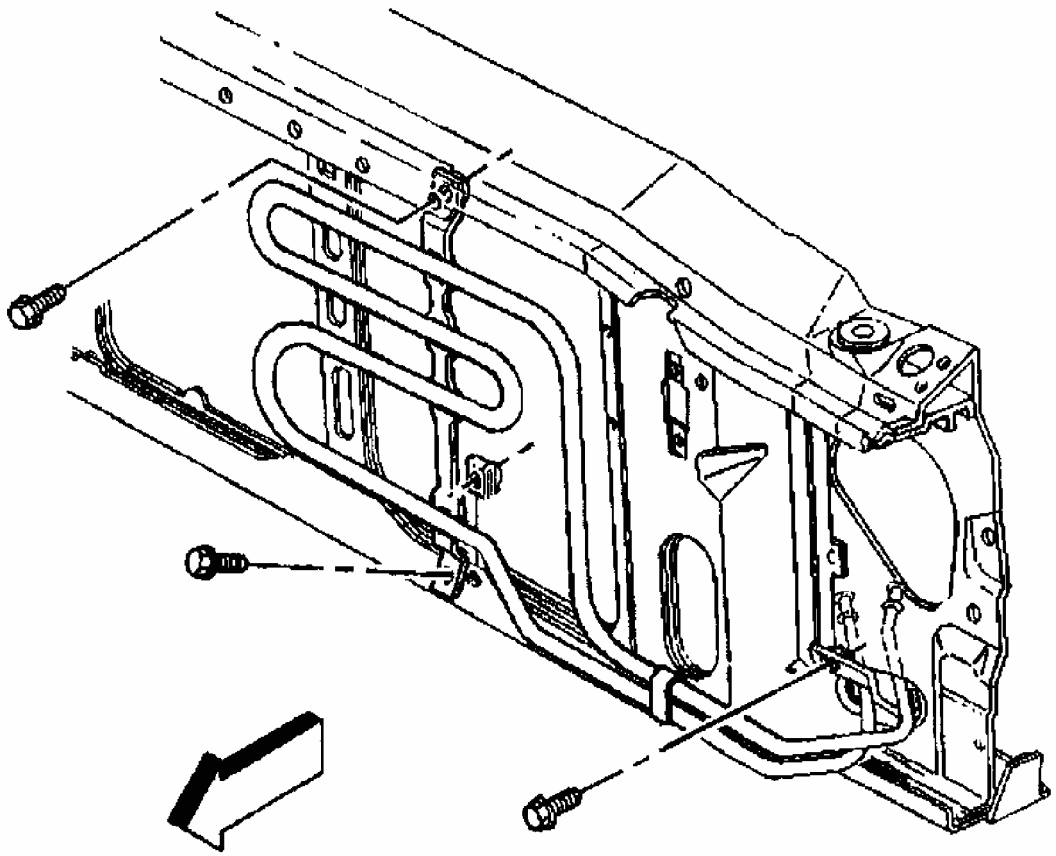


Fig. 96: Power Steering Cooler Retaining Bolts
Courtesy of GENERAL MOTORS CORP.

10. Remove the power steering cooler from the radiator support.

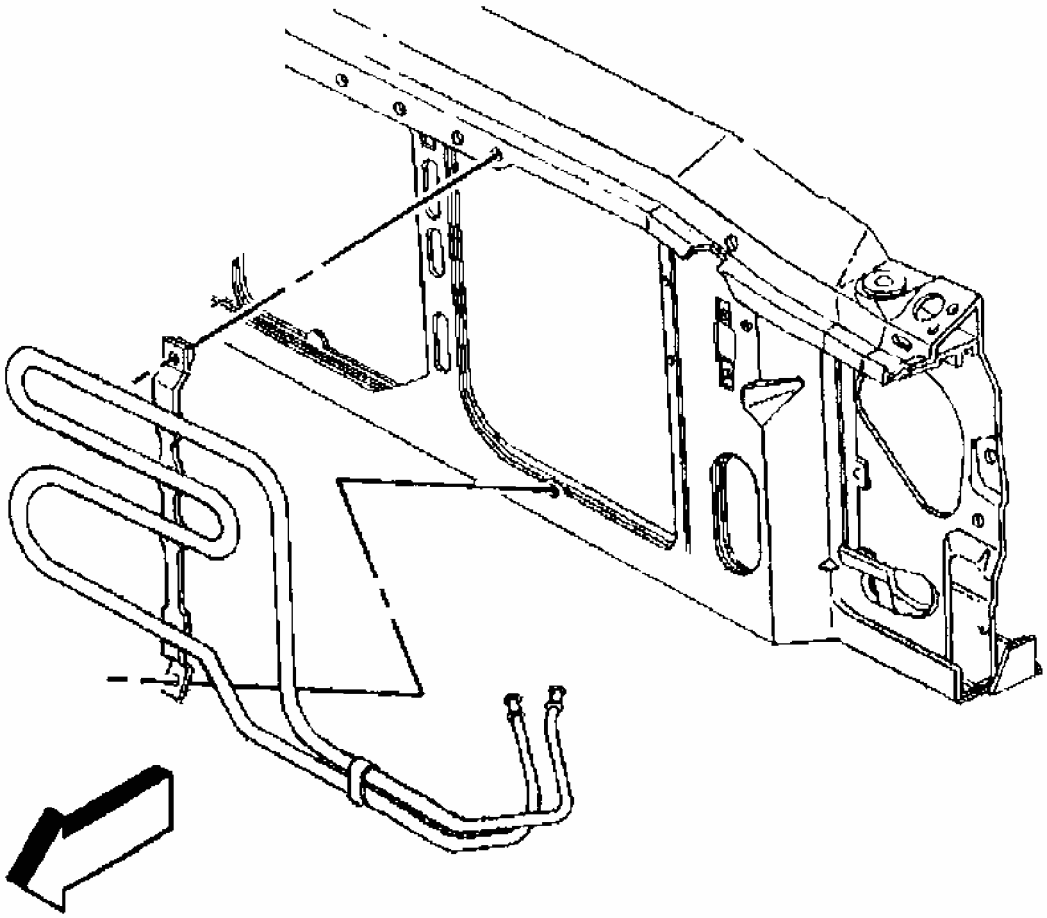


Fig. 97: Removing Power Steering Cooler From Radiator Support
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

NOTE: Refer to INSTALLING HOSES WITHOUT TWISTS OR BENDS NOTICE in Cautions and Notices.

1. Install the power steering cooler to the radiator core support.

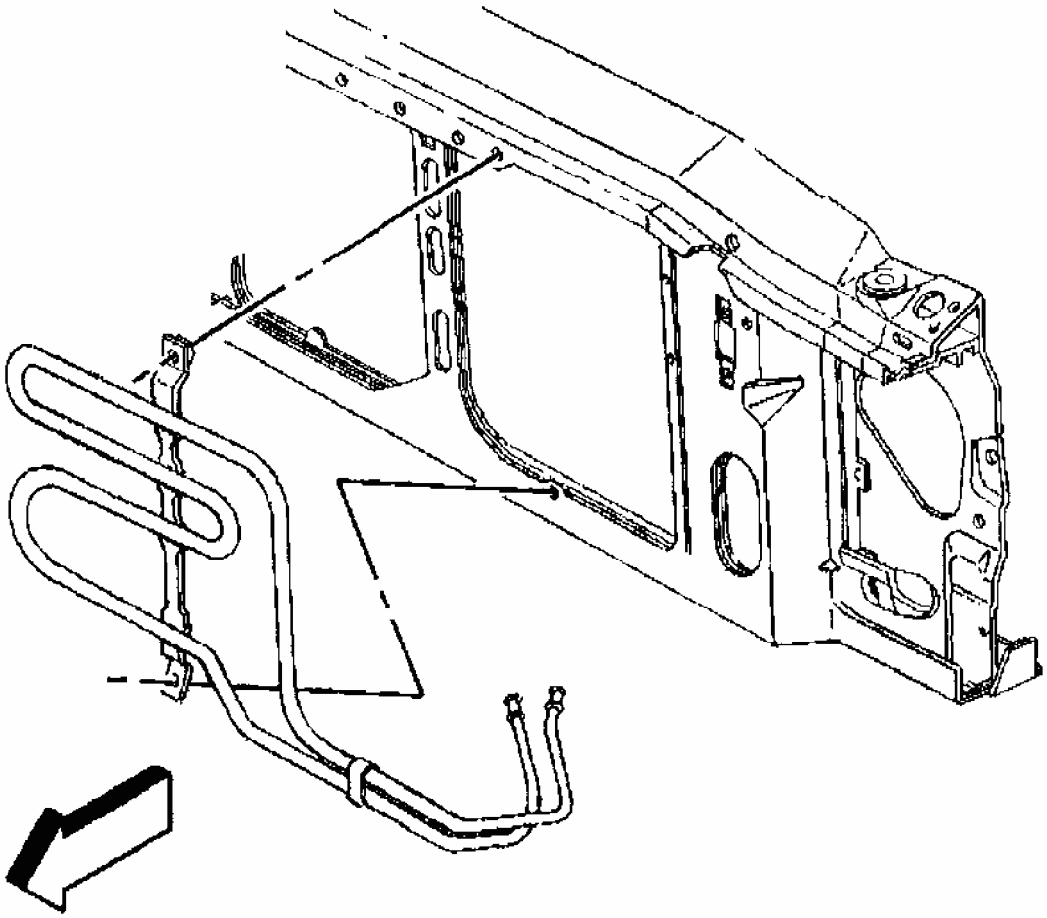


Fig. 98: Installing Power Steering Cooler To Radiator Core Support
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to FASTENER NOTICE in Cautions and Notices.

2. Install the power steering cooler retaining bolts.

Tighten

Tighten the power steering cooler retaining bolts to 10 N.m (7 lb ft).

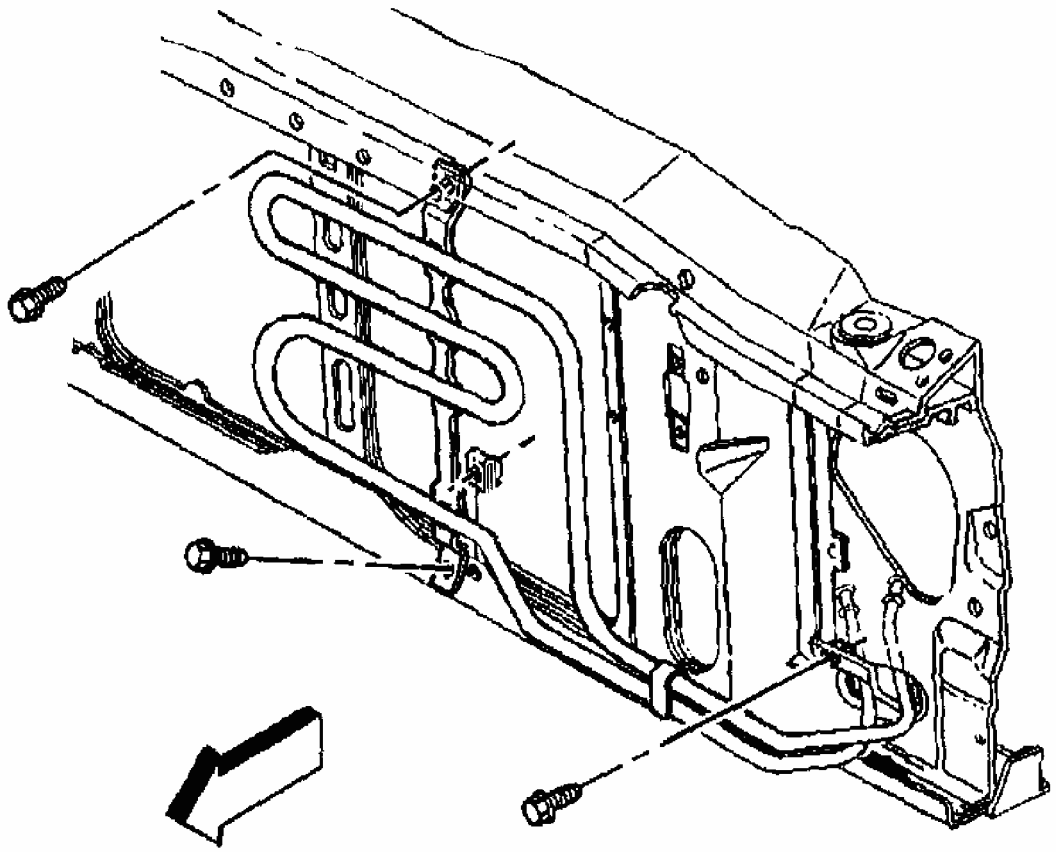


Fig. 99: Power Steering Cooler Retaining Bolts
Courtesy of GENERAL MOTORS CORP.

3. Reposition the hood latch support to the radiator core support.
4. Install the hood latch support mounting bolts.

Tighten

Tighten the hood latch support mounting bolts to 25 N.m (18 lb ft).

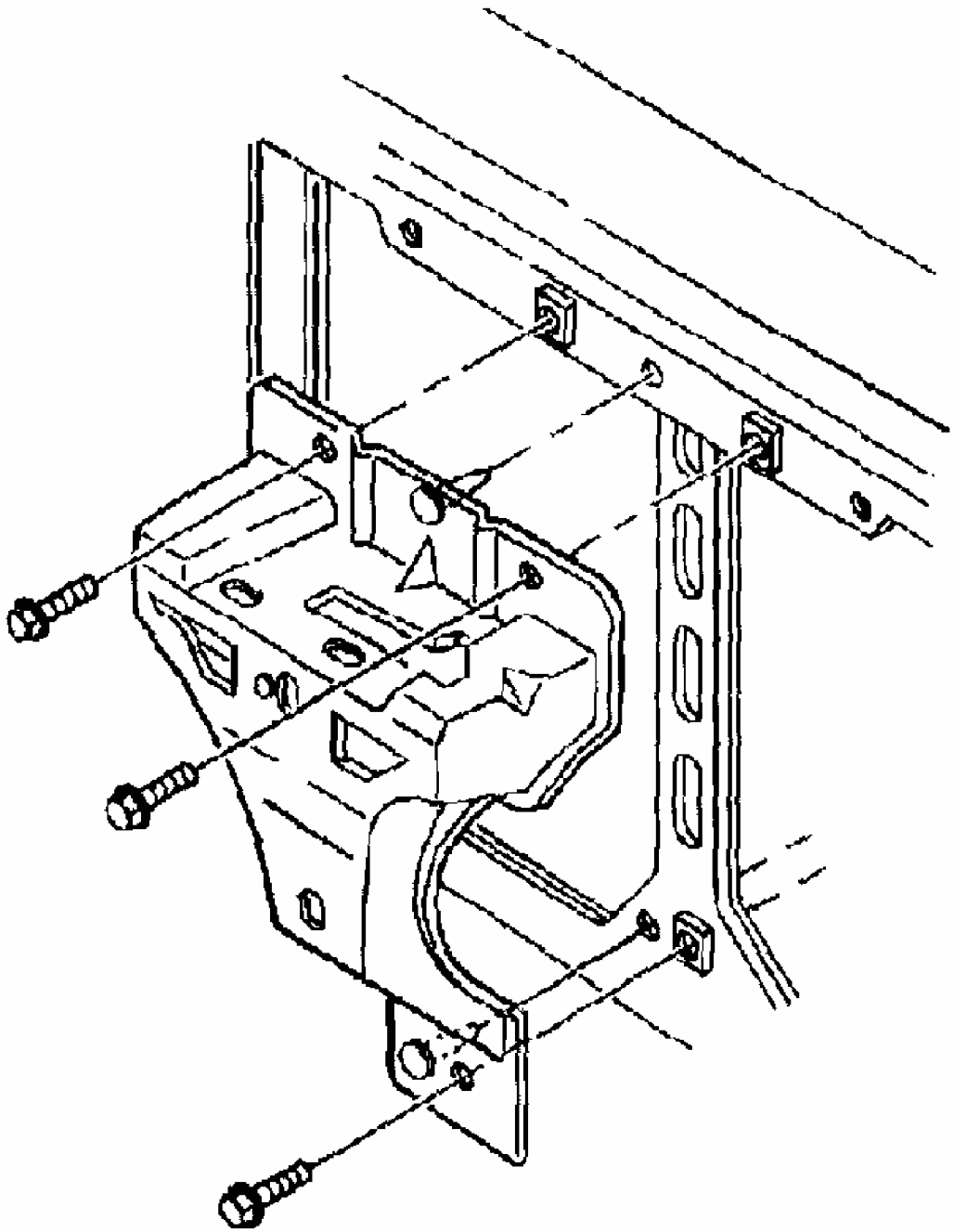
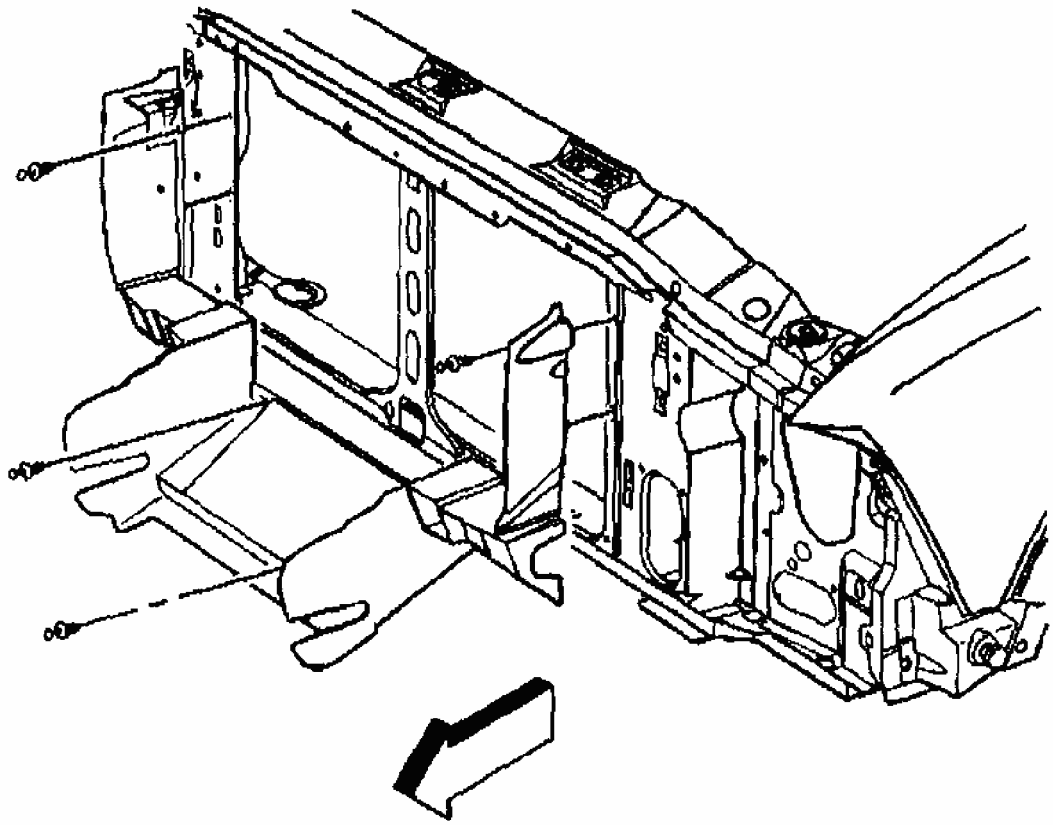


Fig. 100: Hood Latch Support Mounting Bolts
Courtesy of GENERAL MOTORS CORP.

5. Reposition the radiator air intake baffle to the radiator core support.
6. Install the radiator air intake baffle retaining clips to the LH side.

7. Install the grille. Refer to **GRILLE REPLACEMENT (GMC)** or **GRILLE REPLACEMENT (CHEVROLET)** in Exterior Trim.



G01467217

Fig. 101: Installing Radiator Air Intake Baffle Retaining Clips To LH Side Courtesy of GENERAL MOTORS CORP.

8. Connect the power steering cooler hoses to the power steering cooler.

   Tighten

   Tighten the power steering cooler hoses to the power steering cooler clamps to 2 N.m (18 lb in).

9. Remove the drain pan from under the vehicle.
10. Install the air cleaner assembly. Refer to AIR CLEANER ASSEMBLY REPLACEMENT in Engine Controls 4.3L.
11. Bleed the power steering system. Refer to **BLEEDING THE POWER STEERING SYSTEM** .

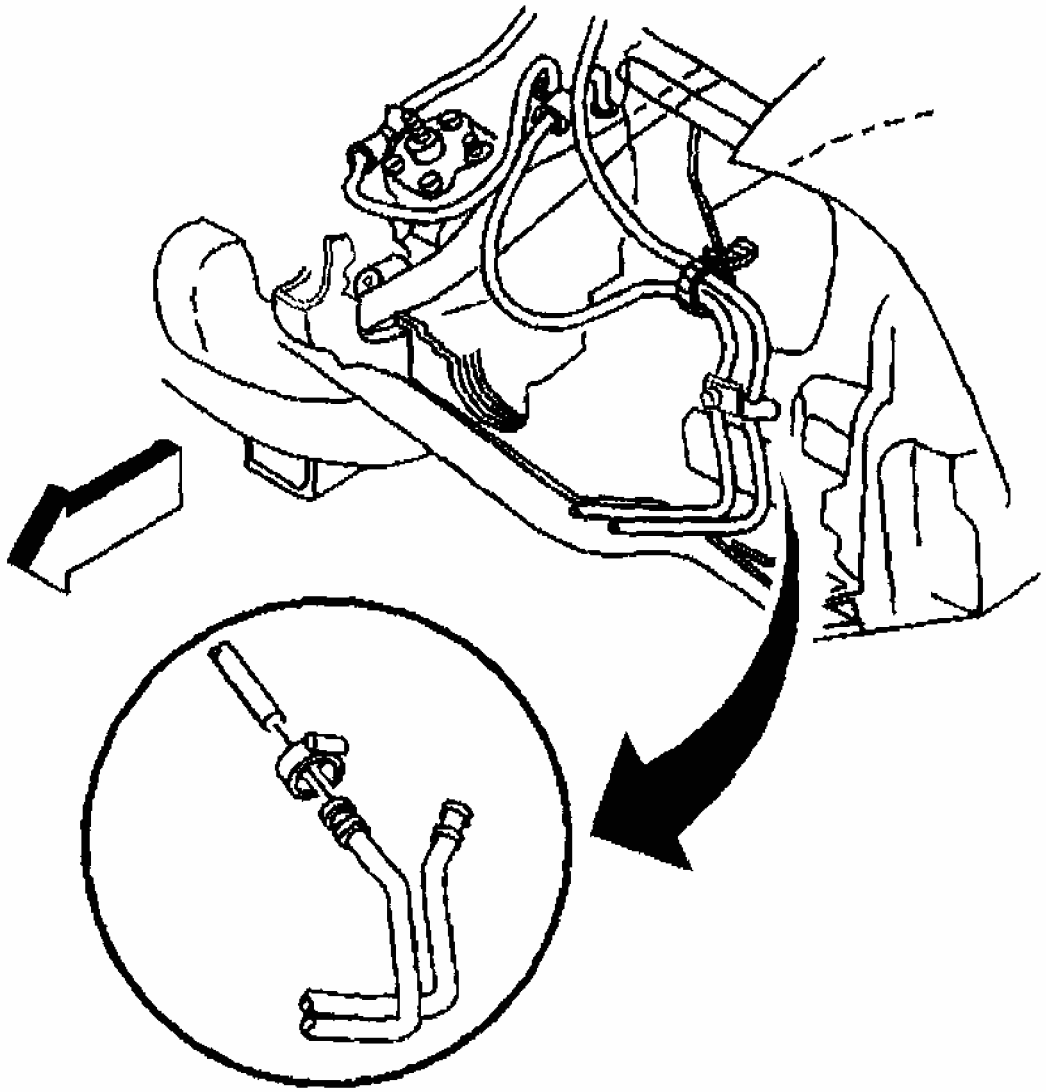


Fig. 102: Connecting Power Steering Cooler Hoses To Power Steering Cooler
Courtesy of GENERAL MOTORS CORP.

POWER STEERING PRESSURE HOSE REPLACEMENT (2.2L)

Removal Procedure

NOTE: Refer to POWER STEERING HOSE DISCONNECTED NOTICE in Cautions and Notices.

1. Remove the air cleaner assembly.
2. Install a drain pan under the vehicle.

3. Disconnect the power steering gear pressure hose from the power steering pump.

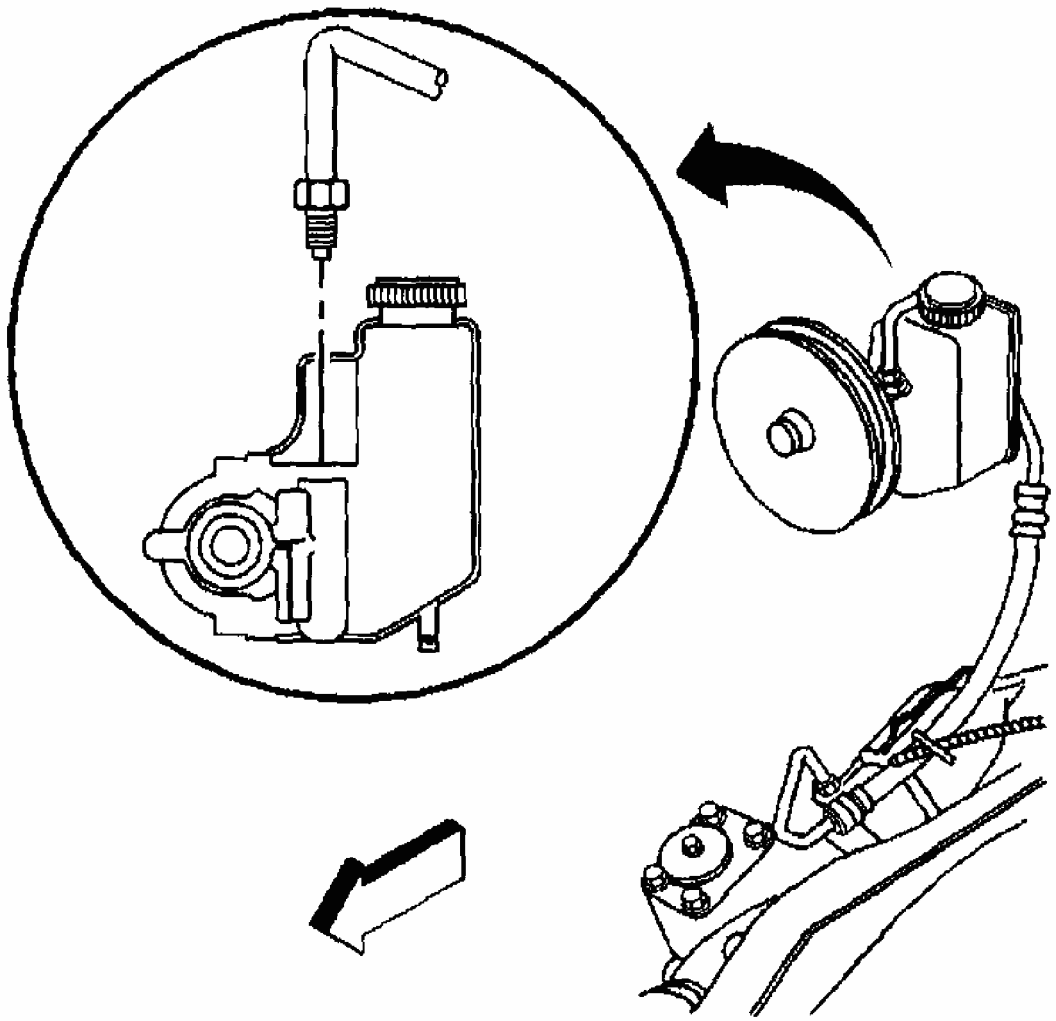
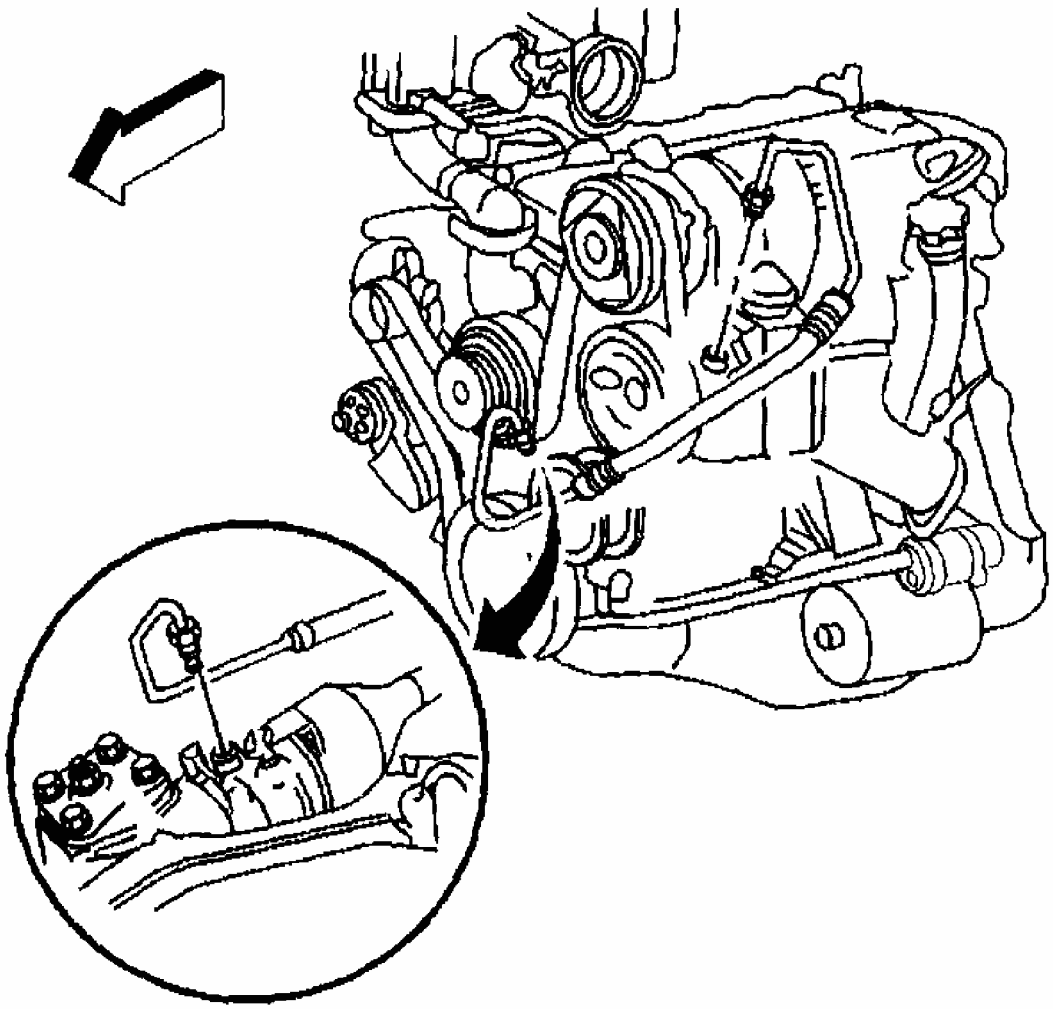


Fig. 103: Disconnecting Power Steering Gear Pressure Hose From Power Steering Pump
Courtesy of GENERAL MOTORS CORP.

4. Disconnect the power steering gear pressure hose from the power steering gear.
5. Remove the power steering gear pressure hose from the vehicle.



G01467220

Fig. 104: Removing Power Steering Gear Pressure Hose From Vehicle
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

NOTE: Refer to INSTALLING HOSES WITHOUT TWISTS OR BENDS NOTICE in Cautions and Notices.

1. Install the power steering gear pressure hose to the vehicle.

NOTE: Refer to FASTENER NOTICE in Cautions and Notices.

2. Connect the power steering gear pressure hose to the power steering gear.

Tighten

Tighten the power steering gear pressure hose to the power steering gear to 25 N.m (18 lb ft).

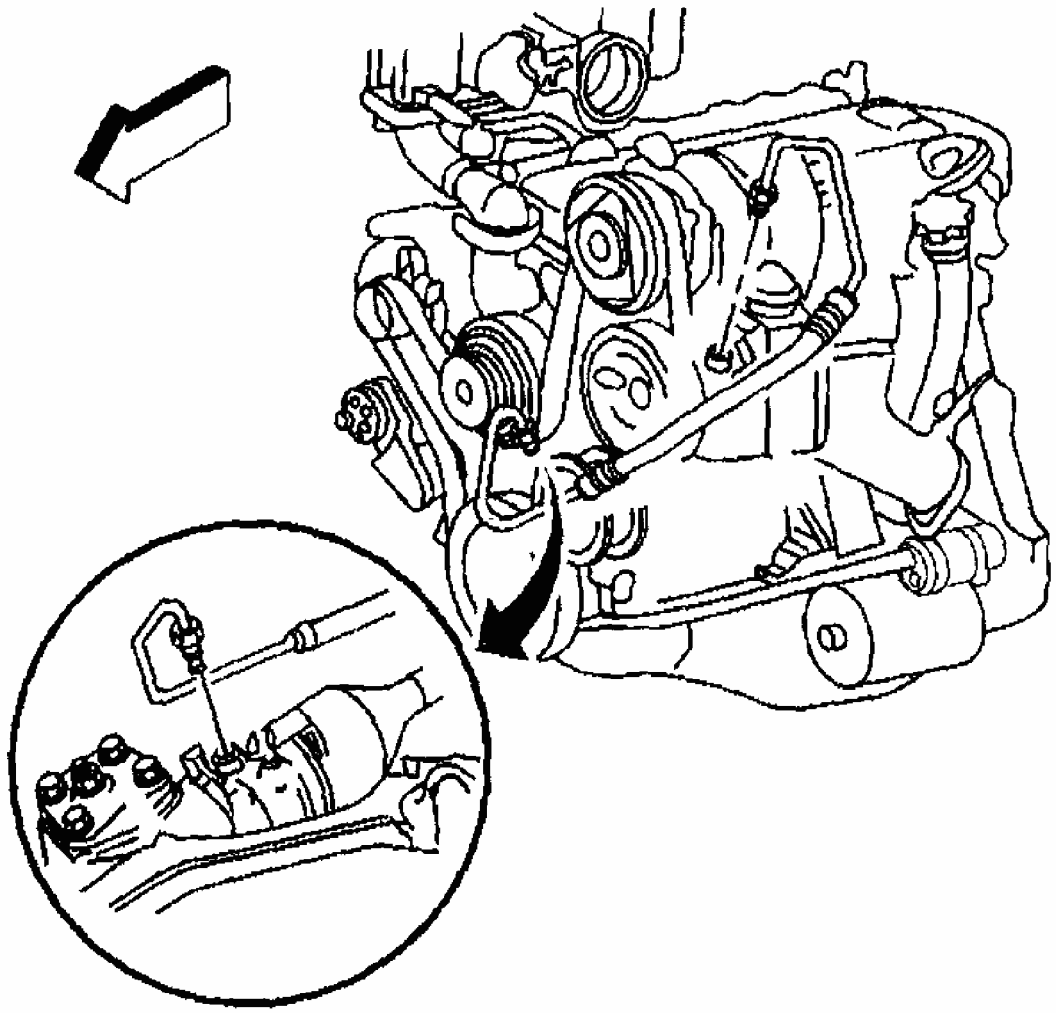


Fig. 105: Installing Power Steering Gear Pressure Hose To Vehicle
Courtesy of GENERAL MOTORS CORP.

3. Connect the power steering gear pressure hose to the power steering pump.

Tighten

Tighten the power steering gear pressure hose to the power steering pump to 25 N.m (18 lb ft).

4. Remove the drain pan from under the vehicle.
5. Install the air cleaner assembly.
6. Bleed the power steering system. Refer to **BLEEDING THE POWER STEERING SYSTEM** .

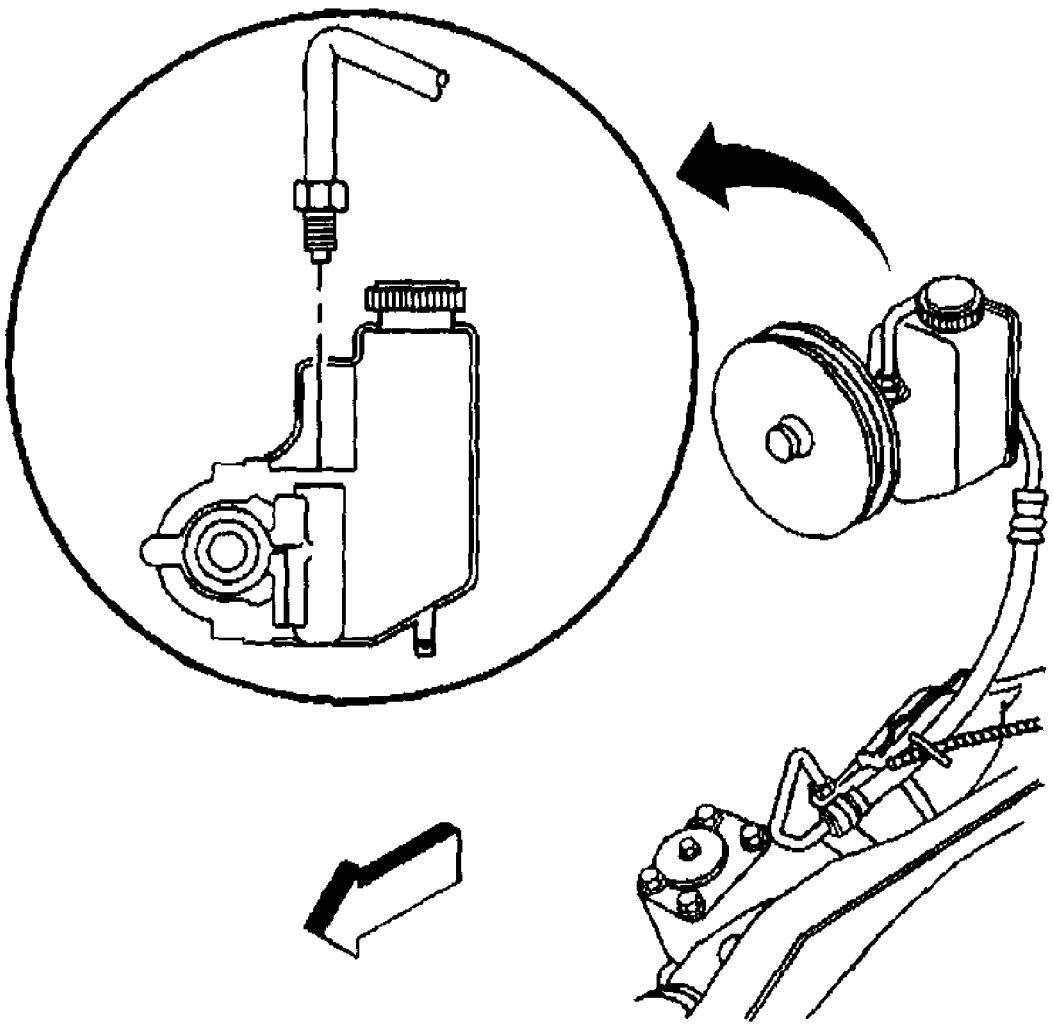


Fig. 106: Connecting Power Steering Gear Pressure Hose To Power Steering Pump
Courtesy of GENERAL MOTORS CORP.

POWER STEERING PRESSURE HOSE REPLACEMENT (4.3L)

Removal Procedure

NOTE: **Refer to POWER STEERING HOSE DISCONNECTED NOTICE in Cautions and Notices.**

1. Raise and suitably support the vehicle. Refer to **LIFTING AND JACKING THE VEHICLE** in General Information.
2. Remove the steering linkage shield, if equipped. Refer to **STEERING LINKAGE SHIELD REPLACEMENT** in Steering Linkage.
3. Install a drain pan under the vehicle.
4. Disconnect the pressure hose from the power steering pump.
5. Lower the vehicle.
6. Remove the air cleaner assembly. Refer to AIR CLEANER ASSEMBLY REPLACEMENT in Engine Controls 4.3L.

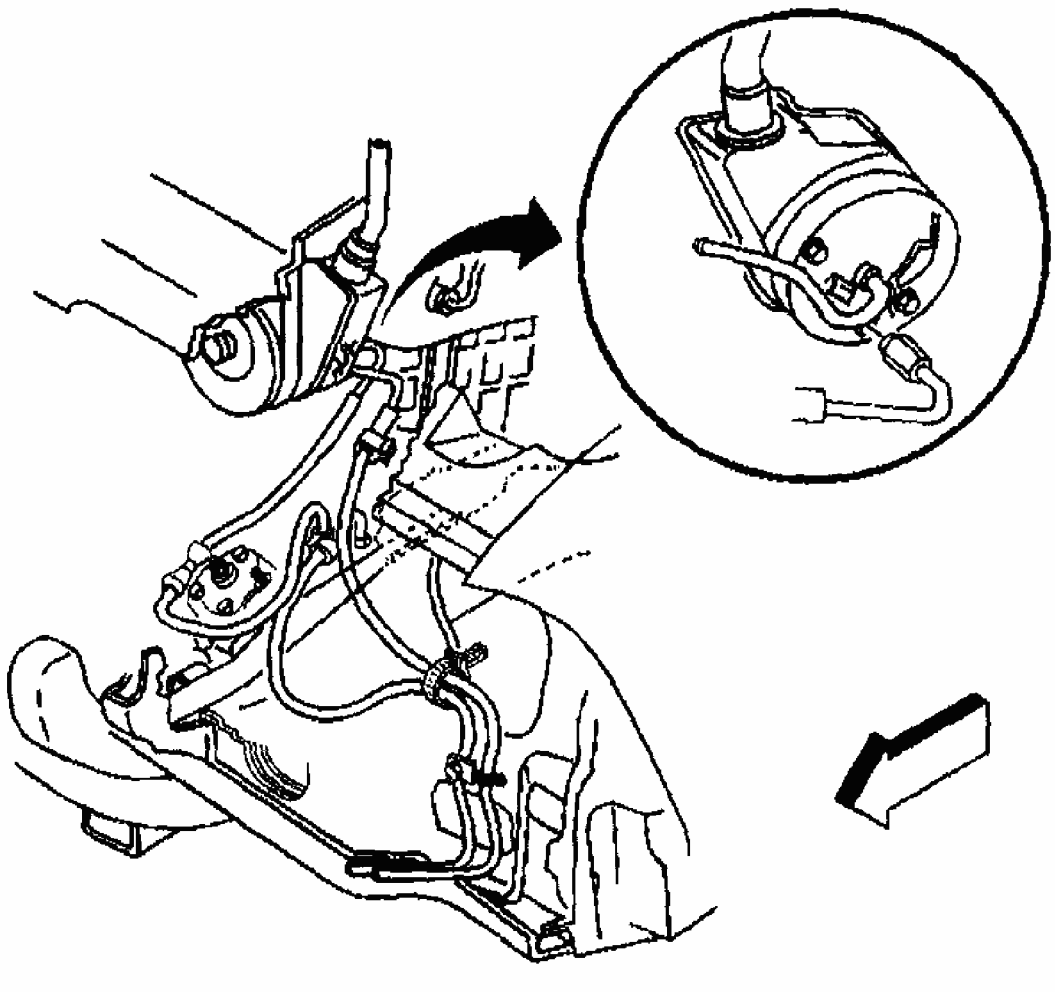


Fig. 107: Disconnecting Pressure Hose From Power Steering Pump
Courtesy of GENERAL MOTORS CORP.

7. Disconnect the power steering gear pressure hose from the power steering gear.

8. Remove the power steering gear pressure hose from the vehicle.

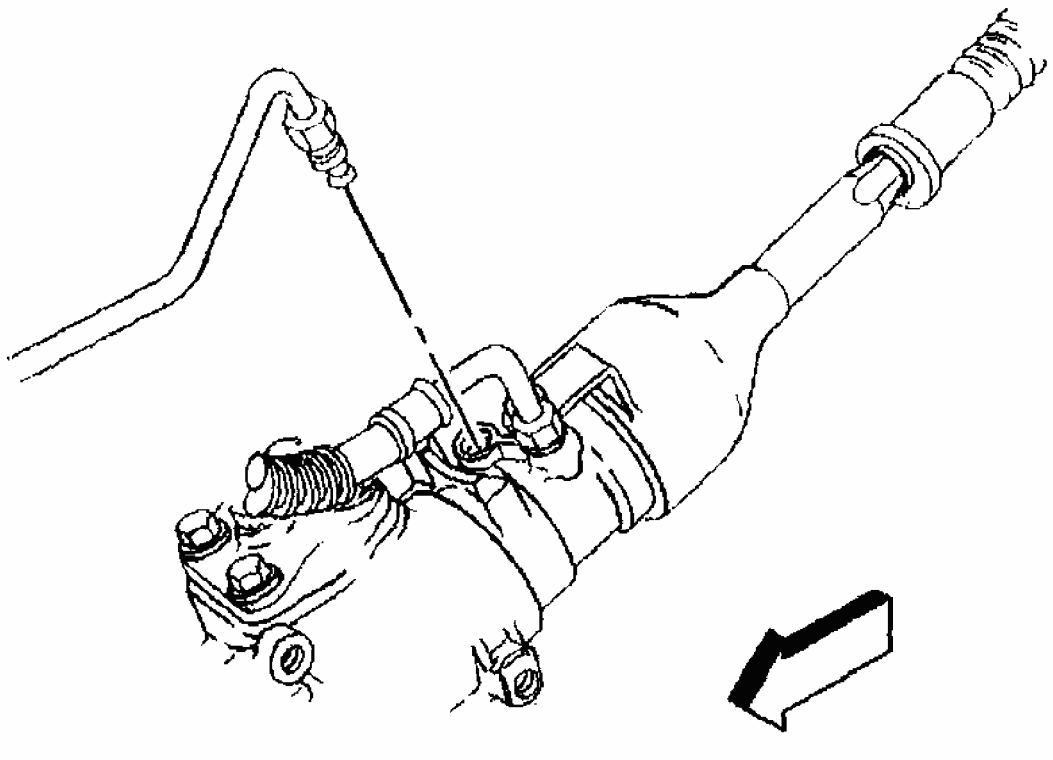


Fig. 108: Disconnecting Power Steering Gear Pressure Hose From Power Steering Gear
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

NOTE: Refer to INSTALLING HOSES WITHOUT TWISTS OR BENDS NOTICE in Cautions and Notices.

1. Install the power steering gear pressure hose to the vehicle.

   NOTE: Refer to FASTENER NOTICE in Cautions and Notices.

2. Connect the power steering gear pressure hose to the power steering gear.

   Tighten

   Tighten the power steering gear pressure hose to the power steering gear to 30 N.m (22 lb ft).

3. Install the air cleaner assembly. Refer to AIR CLEANER ASSEMBLY REPLACEMENT in Engine Controls 4.3L.
4. Raise the vehicle.

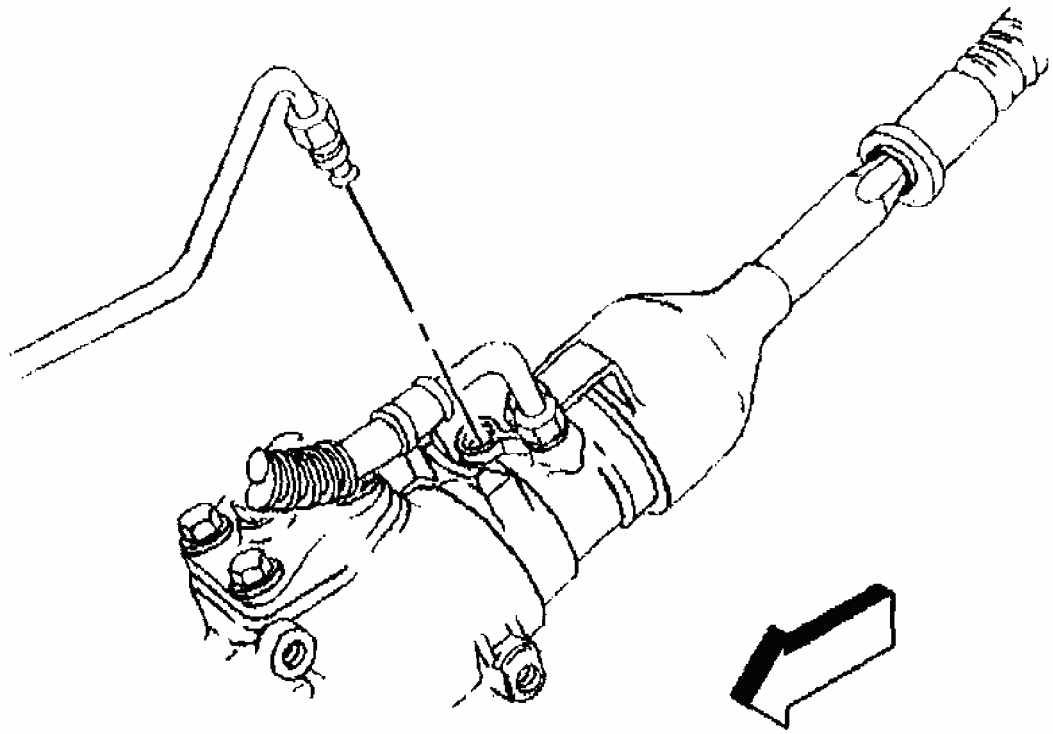


Fig. 109: Connecting Power Steering Gear Pressure Hose To Power Steering Gear
Courtesy of GENERAL MOTORS CORP.

5. Connect the power steering gear pressure hose to the power steering pump.

   Tighten

   Tighten the power steering gear pressure hose to the power steering pump to 25 N.m (18 lb ft).

6. Remove the drain pan from under the vehicle.
7. Install the steering linkage shield, if equipped. Refer to **STEERING LINKAGE SHIELD REPLACEMENT** in Steering Linkage.
8. Lower the vehicle.
9. Bleed the power steering system. Refer to **BLEEDING THE POWER STEERING SYSTEM** .

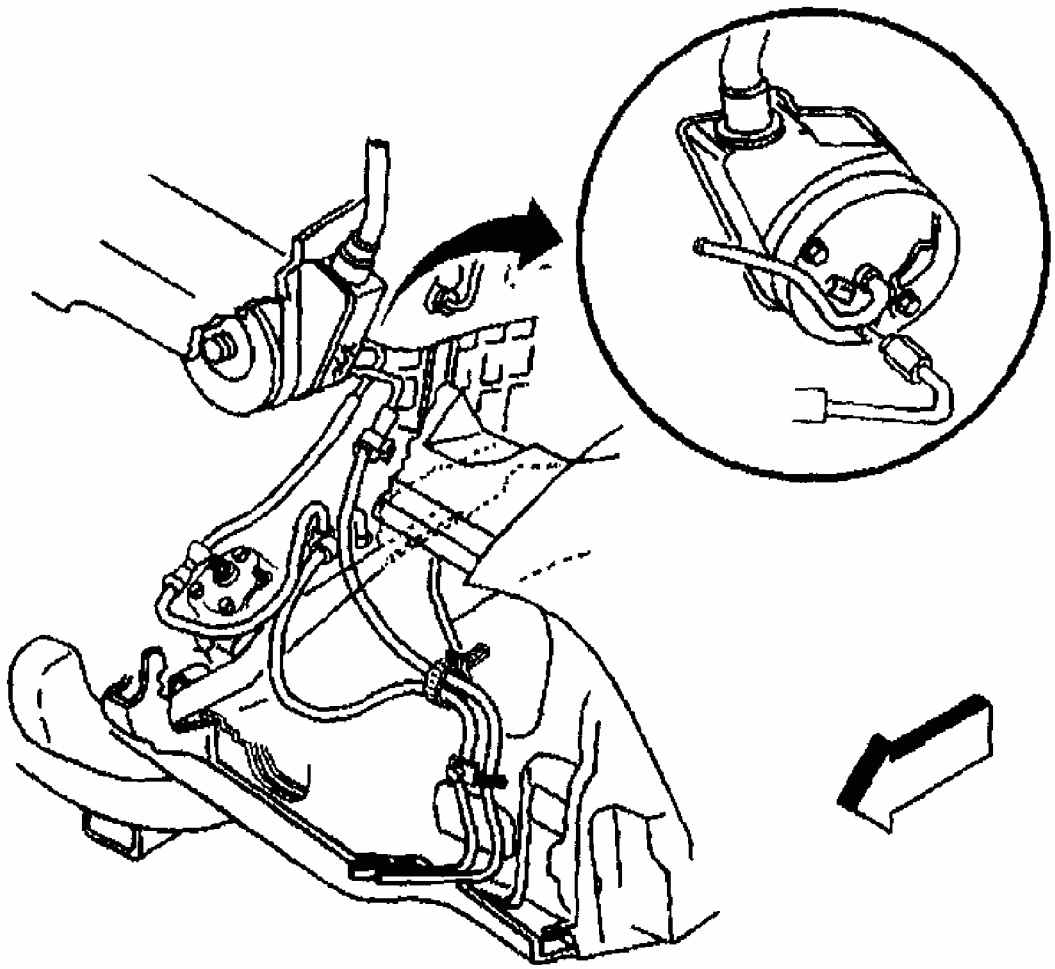


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Fig. 110: Connecting Power Steering Gear Pressure Hose To Power Steering Pump
Courtesy of GENERAL MOTORS CORP.

POWER STEERING RETURN HOSE REPLACEMENT (2.2L)

Removal Procedure

NOTE: Refer to POWER STEERING HOSE DISCONNECTED NOTICE in Cautions and Notices.

1. Remove the air cleaner assembly.
2. Install a drain pan under the vehicle.
3. Disconnect the power steering gear return hose from the power steering pump (for vehicles without a power steering cooler).

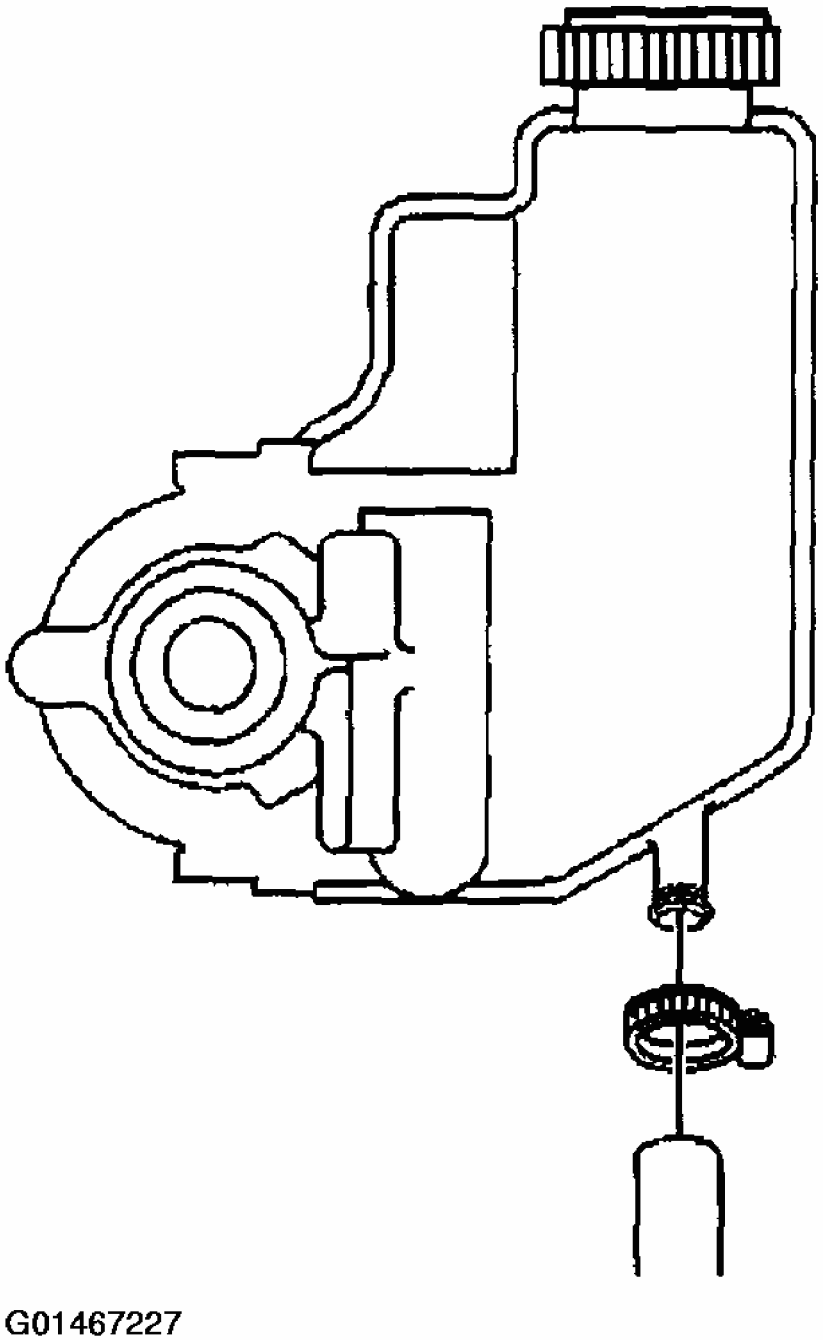

Fig. 111: Disconnecting Power Steering Gear Return Hose From Power Steering Pump
Courtesy of GENERAL MOTORS CORP.

4. Disconnect the power steering gear return hose from the power steering cooler, if equipped.

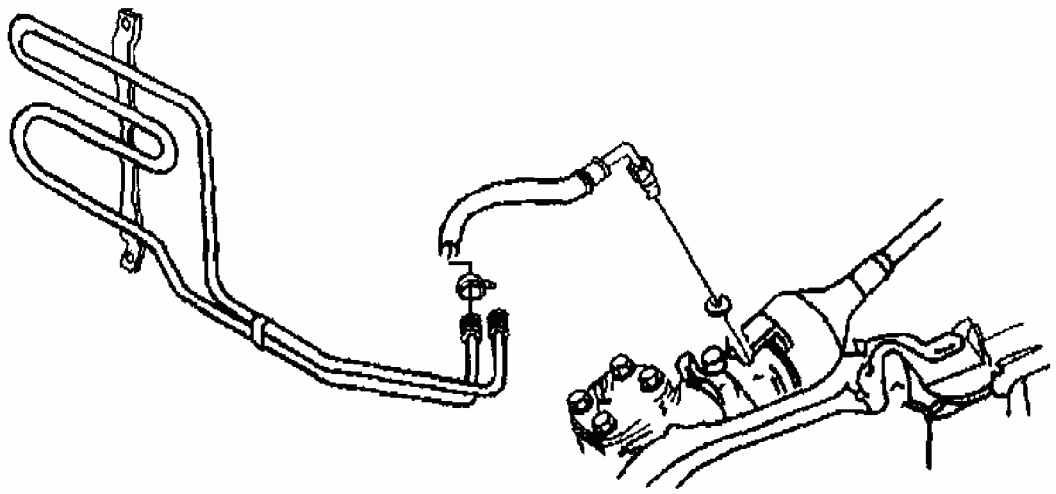

Fig. 112: Disconnecting Power Steering Gear Return Hose From Power Steering Cooler
Courtesy of GENERAL MOTORS CORP.

5. Disconnect the power steering gear return hose from the power steering gear.
6. Remove the power steering gear return hose from the vehicle.

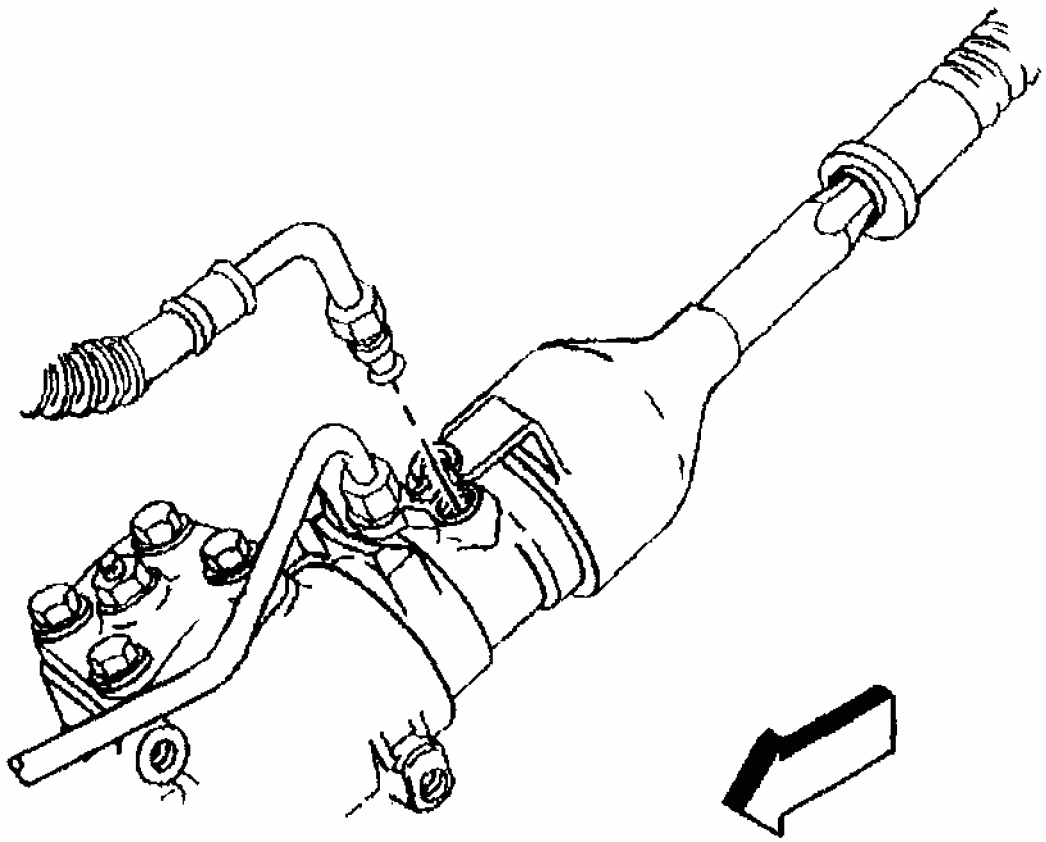

Fig. 113: Disconnecting Power Steering Gear Return Hose From Power Steering Gear
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

NOTE: Refer to INSTALLING HOSES WITHOUT TWISTS OR BENDS NOTICE in Cautions and Notices.

1. Install the power steering gear return hose to the vehicle.

   NOTE: Refer to FASTENER NOTICE in Cautions and Notices.

2. Connect the power steering gear return hose to the power steering gear.

   Tighten

   Tighten to power steering gear return hose to the power steering gear to 25 N.m (18 lb ft).

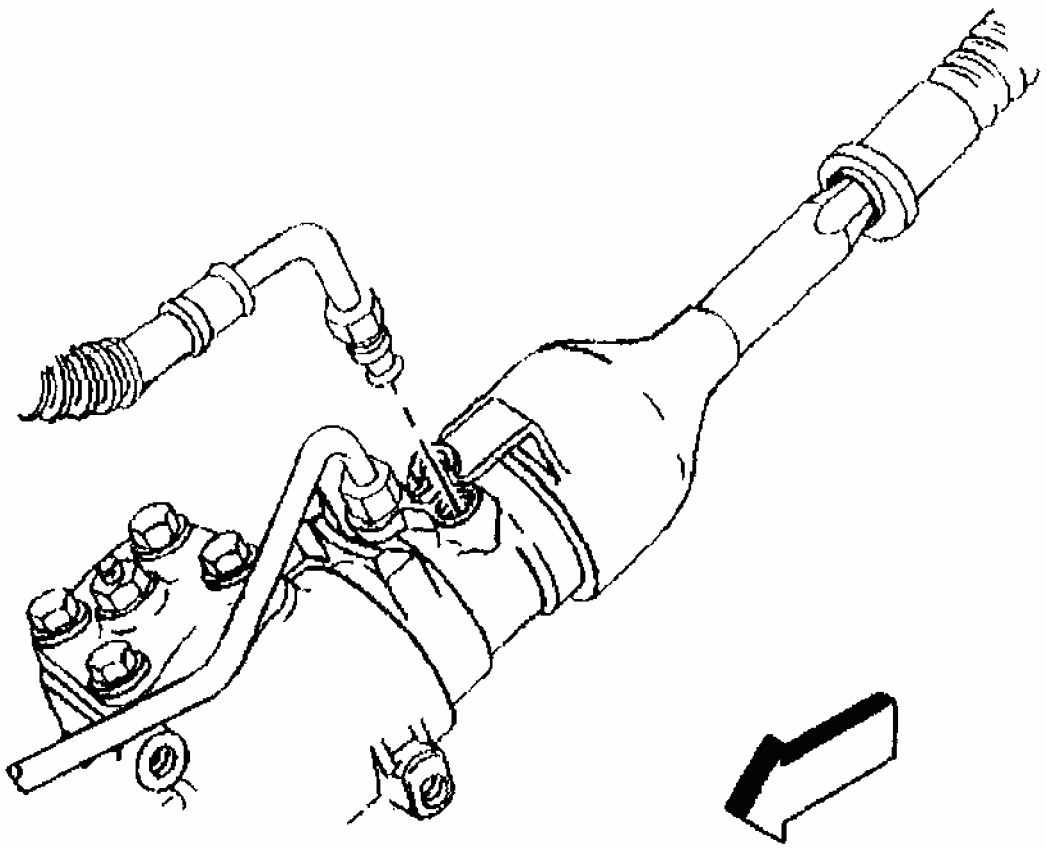

Fig. 114: Connecting Power Steering Gear Return Hose To Power Steering Gear
Courtesy of GENERAL MOTORS CORP.

3. Connect the power steering gear return hose to the power steering cooler, if equipped.

   Tighten

   Tighten the power steering gear return hose to the power steering cooler clamp to 2 N.m (18 lb in).

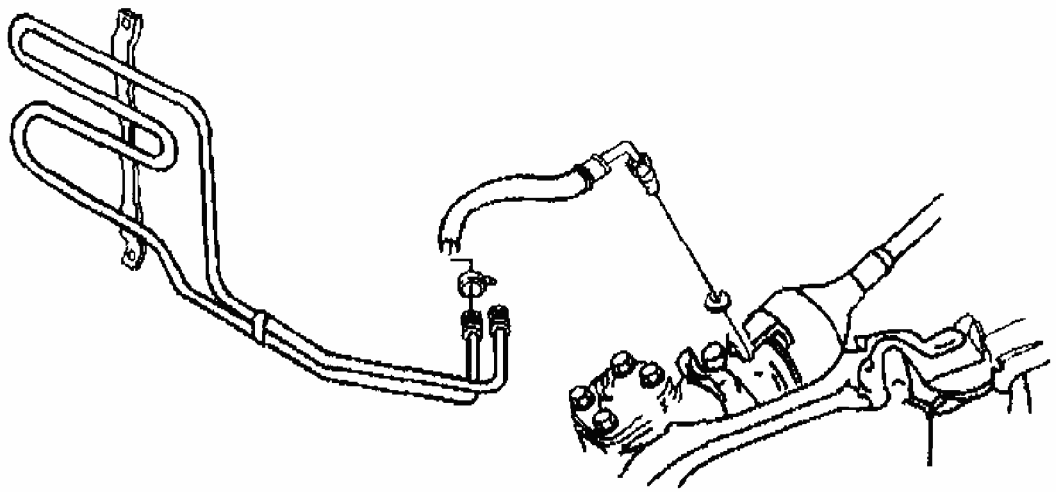

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Fig. 115: Connecting Power Steering Gear Return Hose To Power Steering Cooler
Courtesy of GENERAL MOTORS CORP.

4. Connect the power steering gear return hose to the power steering pump (for vehicles without a power steering cooler).

   Tighten

   Tighten the power steering gear return hose to the power steering pump clamp to 2 N.m (18 lb in).

   Remove the drain pan from under the vehicle.

5. Install the air cleaner assembly.
6. Bleed the power steering system. Refer to **BLEEDING THE POWER STEERING SYSTEM** .

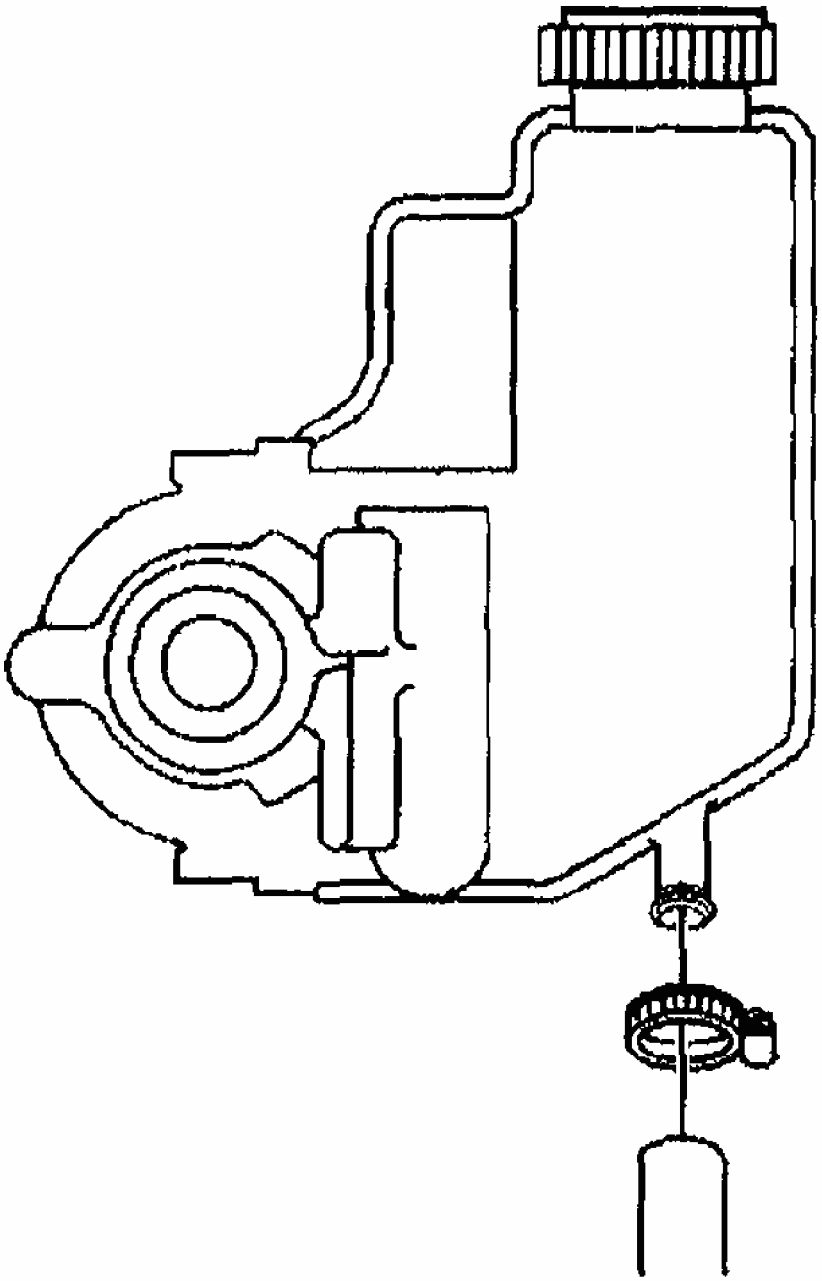

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Fig. 116: Tightening Power Steering Gear Return Hose To Power Steering Pump Clamp
Courtesy of GENERAL MOTORS CORP.

POWER STEERING RETURN HOSE REPLACEMENT (4.3L)

Removal Procedure

NOTE: Refer to POWER STEERING HOSE DISCONNECTED NOTICE in Cautions and Notices.

1. Remove the air cleaner assembly. Refer to AIR CLEANER ASSEMBLY REPLACEMENT in Engine Controls 4.3L.
2. Install a drain pan under the vehicle.
3. Disconnect the power steering gear return hose from the power steering pump (for vehicles without a power steering cooler).

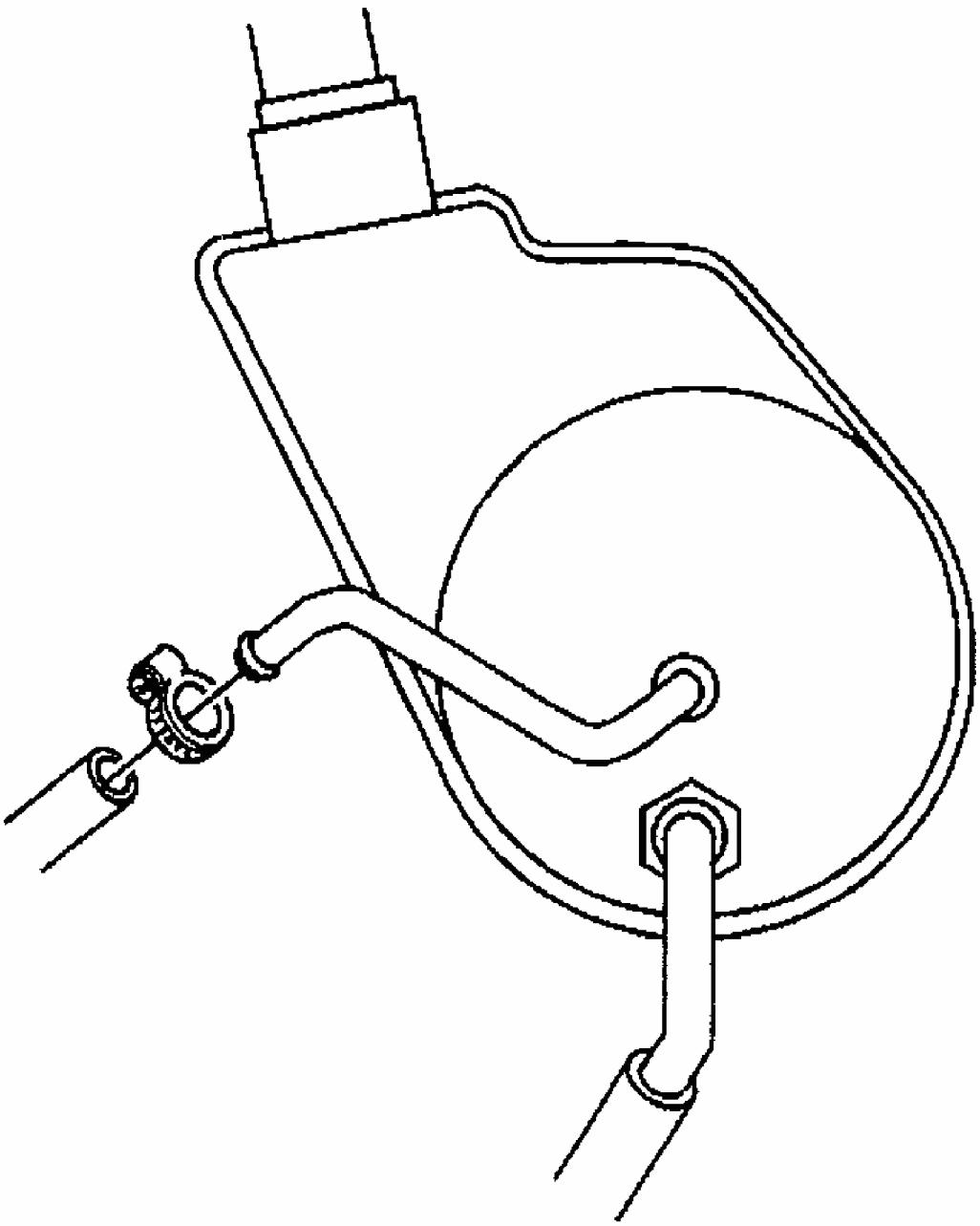

Fig. 117: Disconnecting Power Steering Gear Return Hose From Power Steering Pump
Courtesy of GENERAL MOTORS CORP.

4. Disconnect the power steering gear return hose from the power steering cooler, if equipped.

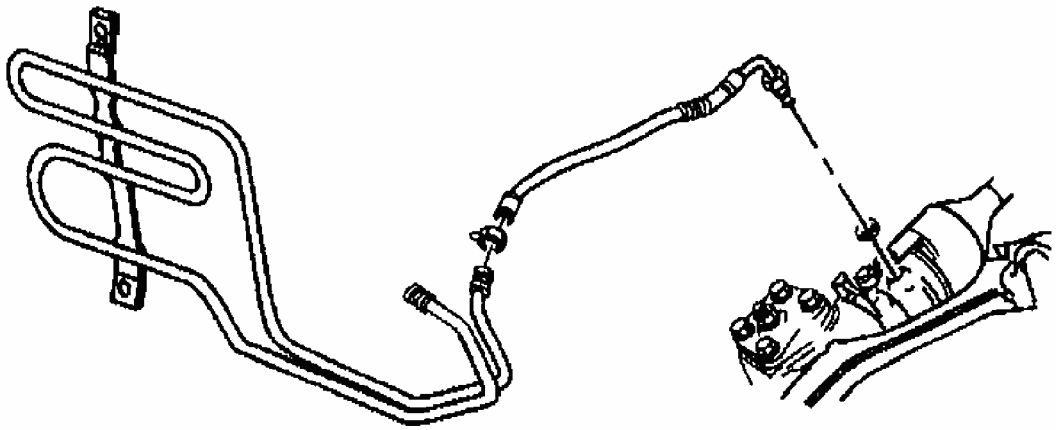

Fig. 118: Disconnecting Power Steering Gear Return Hose From Power Steering Cooler
Courtesy of GENERAL MOTORS CORP.

5. Disconnect the wiring harness clip from the power steering return hose at the power steering gear.
6. Disconnect the power steering gear return hose from the power steering gear.
7. Remove the power steering gear return hose from the vehicle.

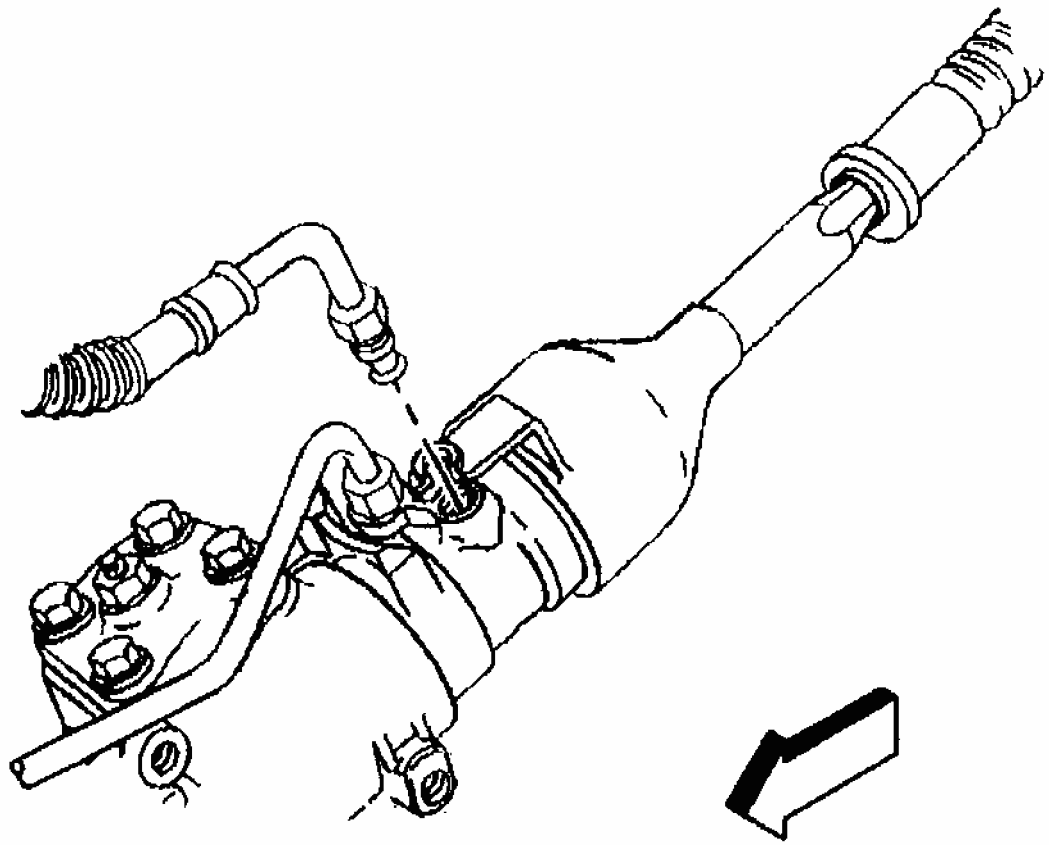

Fig. 119: Disconnecting Power Steering Gear Return Hose From Power Steering Gear
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

NOTE: Refer to INSTALLING HOSES WITHOUT TWISTS OR BENDS NOTICE in Cautions and Notices.

1. Install the power steering gear return hose to the vehicle.

   NOTE: Refer to FASTENER NOTICE in Cautions and Notices.

2. Connect the power steering gear return hose to the power steering gear.

   Tighten

   Tighten the power steering gear return hose to the power steering gear to 30 N.m (22 lb ft).

3. Connect the wiring harness clip to the power steering return hose at the power steering gear.

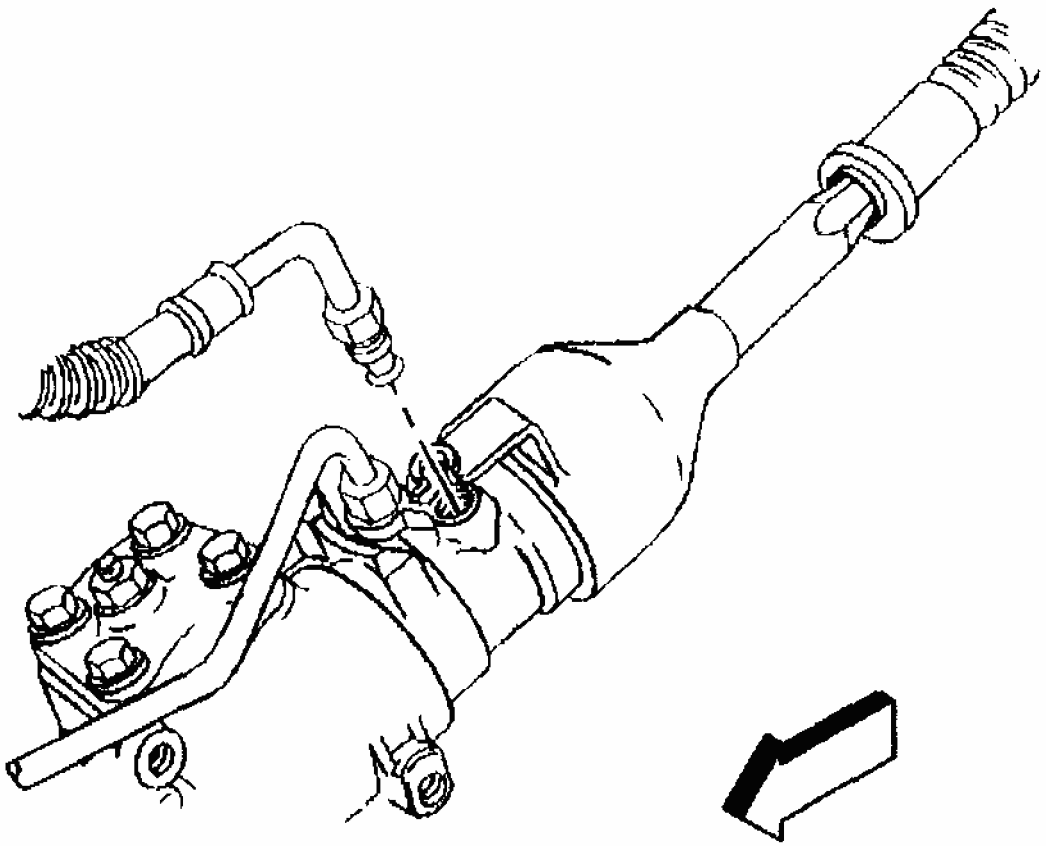

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Fig. 120: Connecting Power Steering Gear Return Hose To Power Steering Gear
Courtesy of GENERAL MOTORS CORP.

4. Connect the power steering gear return hose to the power steering cooler, if equipped.

Tighten

Tighten the power steering gear return hose to the power steering cooler clamp to 2 N.m (18 lb in).

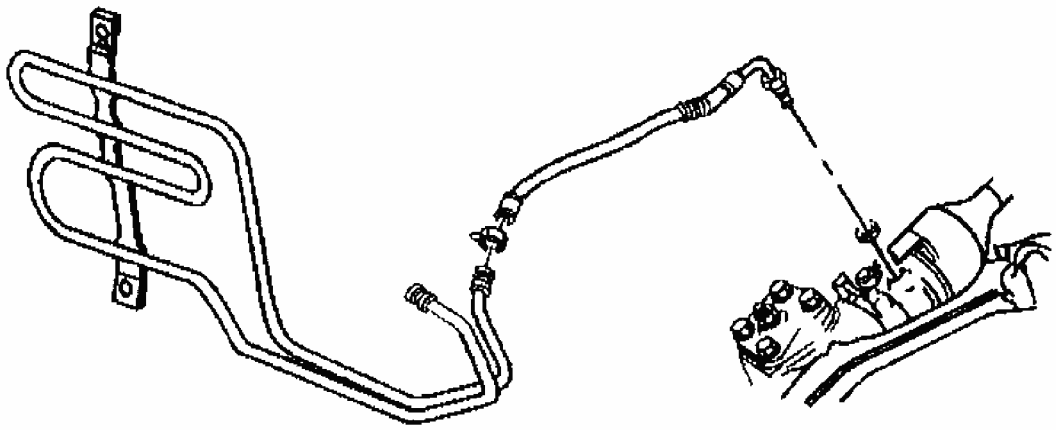

Fig. 121: Connecting Power Steering Gear Return Hose To Power Steering Cooler
Courtesy of GENERAL MOTORS CORP.

5. Connect the power steering gear return hose to the power steering pump (for vehicles without a power steering cooler).

   Tighten

   Tighten the power steering hose clamp to 2 N.m (18 lb in).

6. Remove the drain pan from under the vehicle.
7. Install the air cleaner assembly. Refer to AIR CLEANER ASSEMBLY REPLACEMENT in Engine Controls 4.3L.
8. Bleed the power steering system. Refer to **BLEEDING THE POWER STEERING SYSTEM** .

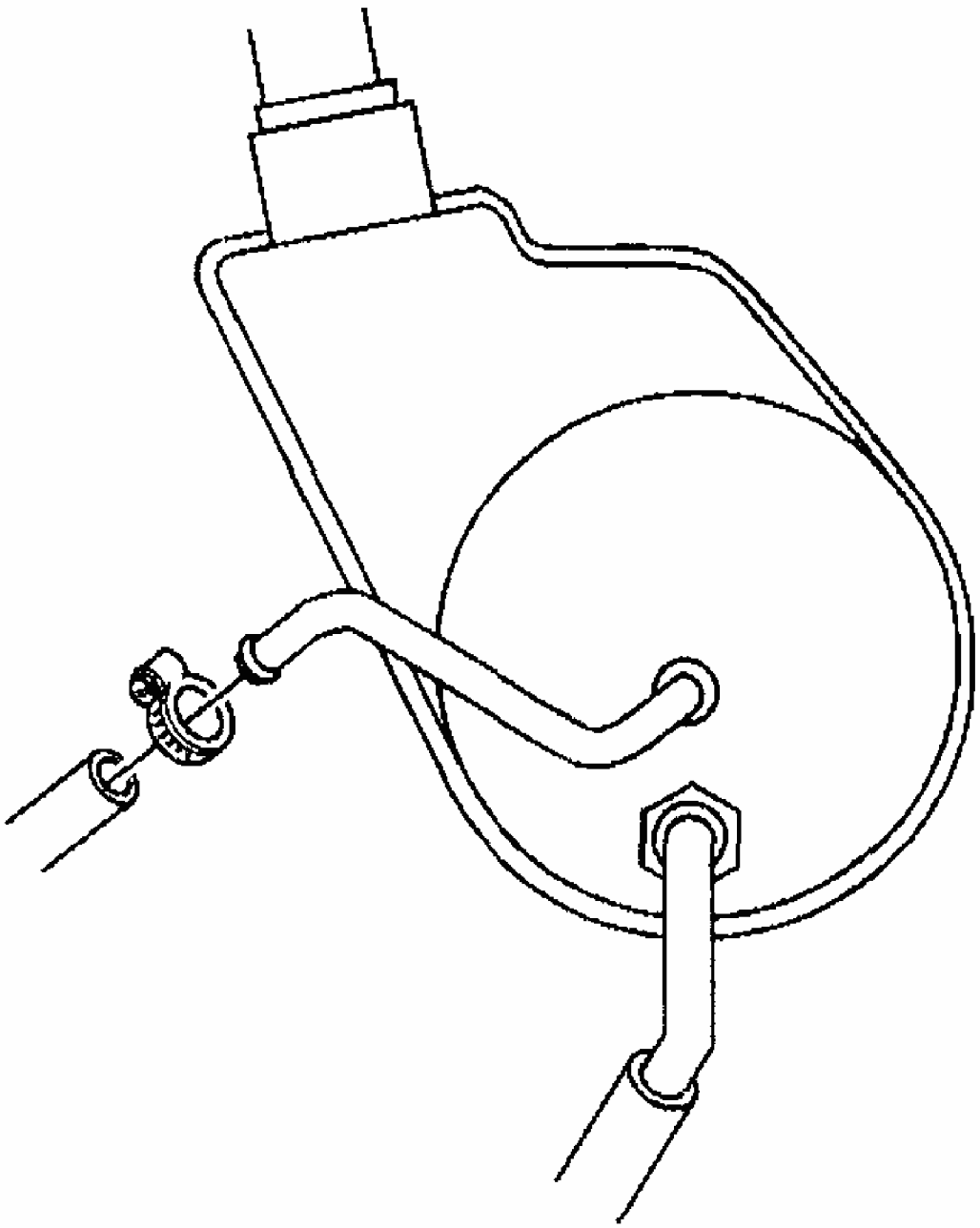

Fig. 122: Tightening Power Steering Hose Clamp
Courtesy of GENERAL MOTORS CORP.

POWER STEERING GEAR REPLACEMENT (RWD)

Tools Required

J 42640 Steering Column Anti-Rotation Pin

Removal Procedure

NOTE: Do not rotate steering shaft after steering column has been removed. Damage to SIR components may occur.

1. Lock the steering column through the access hole in the steering column lower trim cover using the *J 42640* .
2. Remove the air cleaner assembly. Refer to AIR CLEANER OUTLET RESONATOR REPLACEMENT in Engine Controls 2.2L or AIR CLEANER ASSEMBLY REPLACEMENT Engine Controls 4.3L.

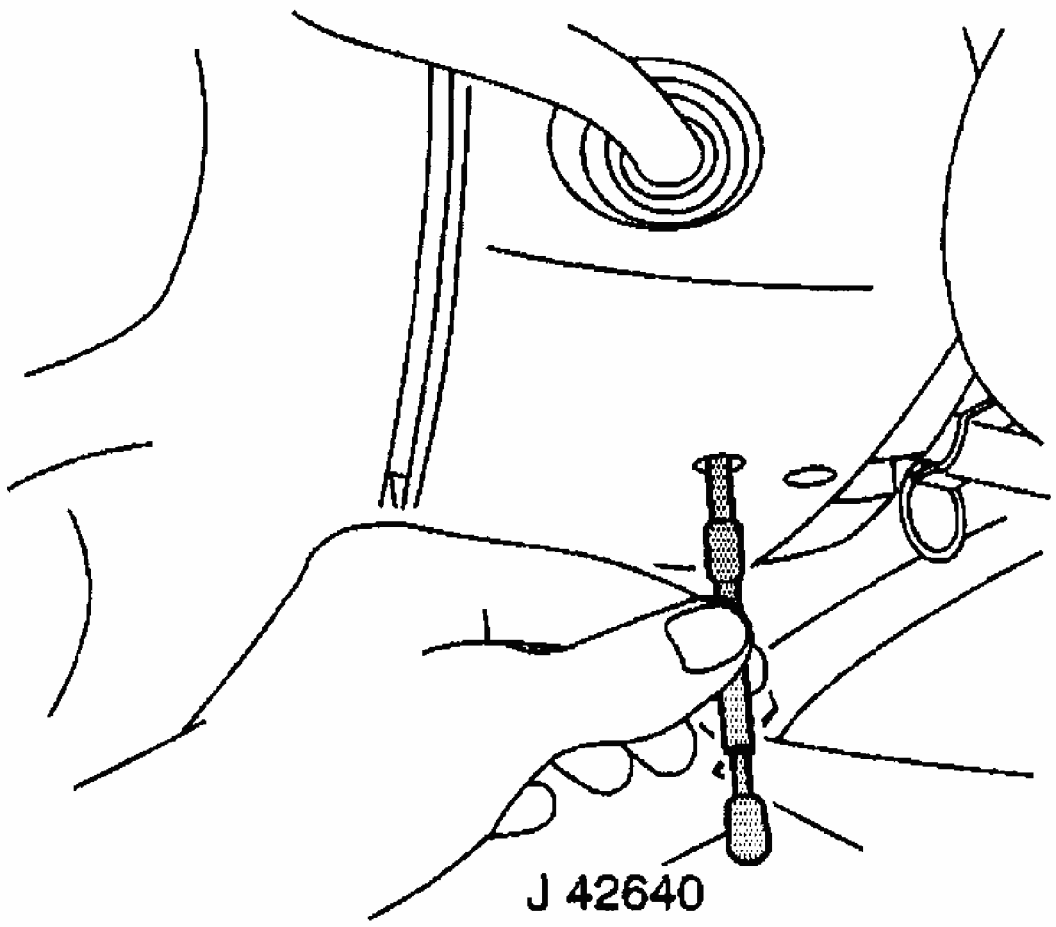

Fig. 123: Locking Steering Column Using Steering Column Anti-Rotation Pin
Courtesy of GENERAL MOTORS CORP.

3. Remove the intermediate shaft shield from the steering gear.

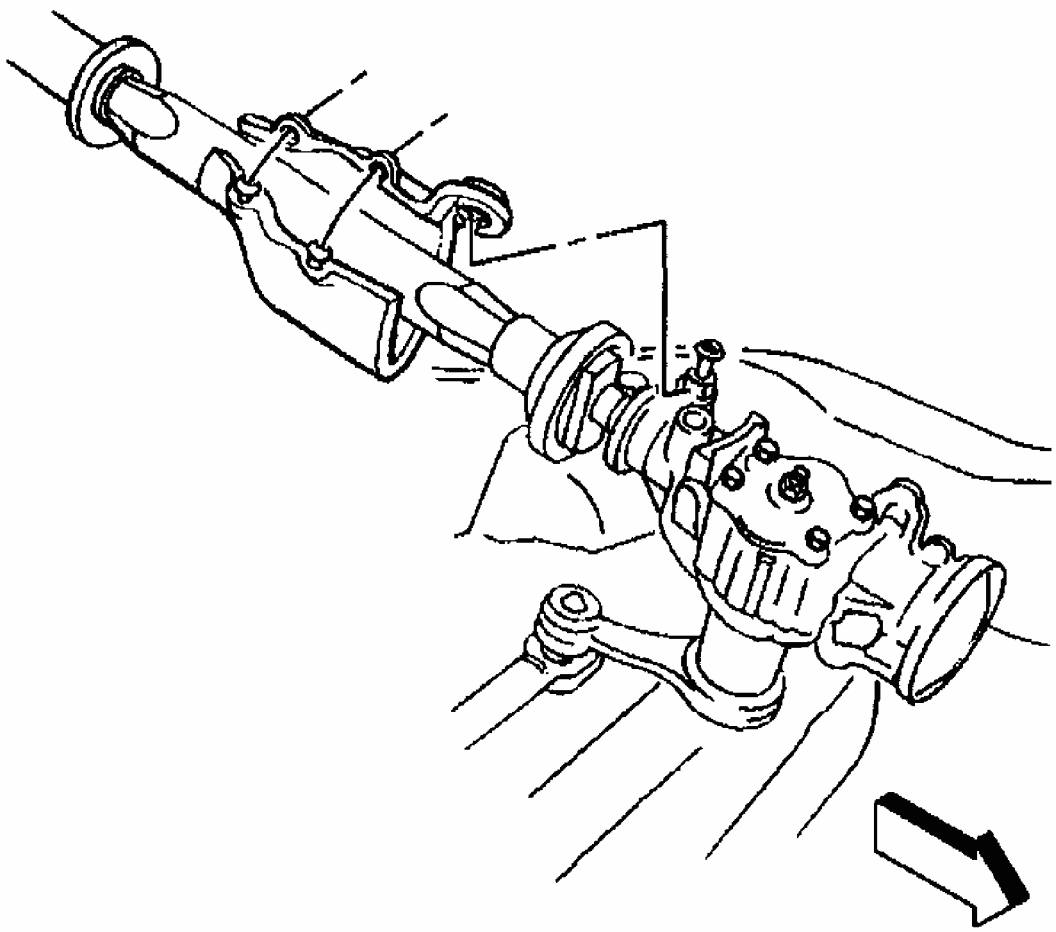

Fig. 124: Removing Intermediate Shaft Shield From Steering Gear
Courtesy of GENERAL MOTORS CORP.

4. Place a drain pan below the steering gear.
5. Remove the pressure and the return hoses from the power steering gear.

   Cap or tape the ends of the hoses and the gear fittings in order to prevent dirt from entering the system.

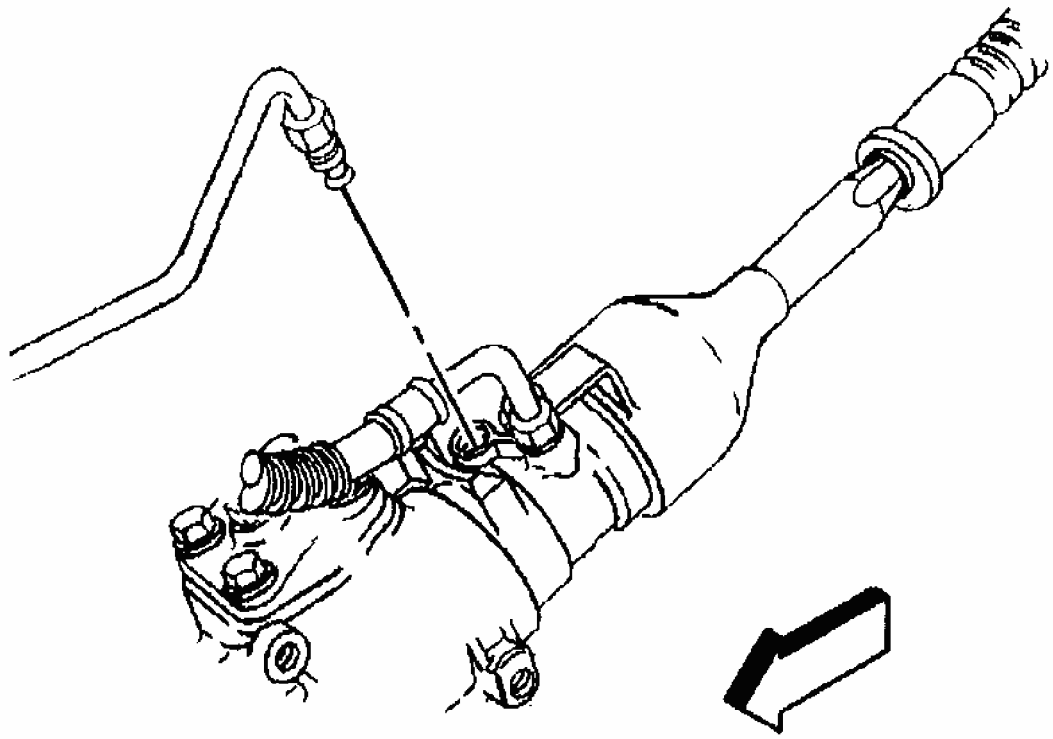

Fig. 125: Removing Pressure & Return Hoses From Power Steering Gear
Courtesy of GENERAL MOTORS CORP.

6. Remove the lower intermediate shaft coupling bolt.
7. Draw alignment marks on the lower intermediate shaft coupling and the steering shaft.
8. Remove the lower intermediate shaft coupling from the steering shaft.
9. Remove the pitman arm. Refer to **PITMAN ARM REPLACEMENT (RWD)** or **PITMAN ARM REPLACEMENT (4WD)** in Steering Linkage.

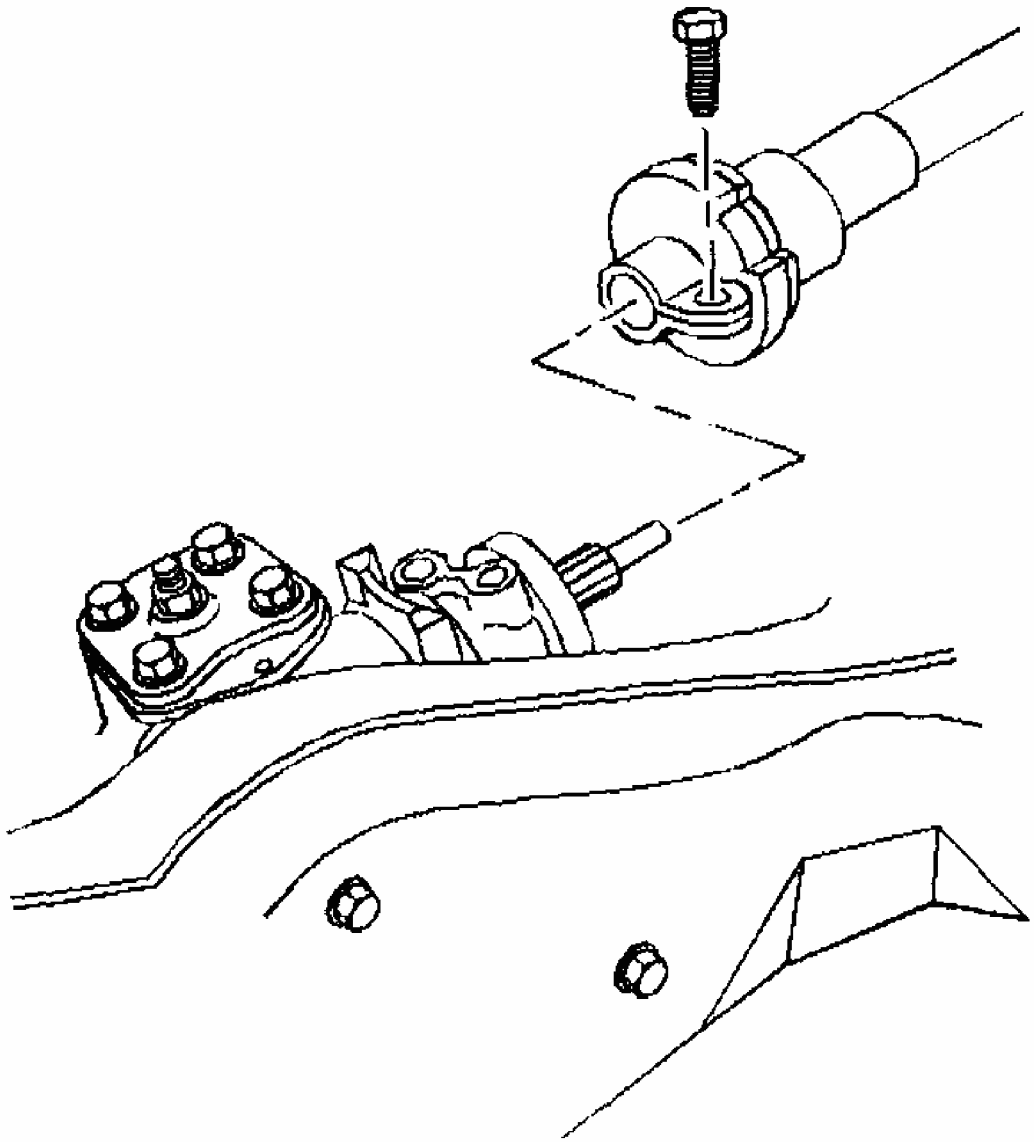

Fig. 126: Lower Intermediate Shaft Coupling Bolt
Courtesy of GENERAL MOTORS CORP.

10. Remove the steering gear mounting bolts and the washers from the frame.
11. Remove the steering gear.

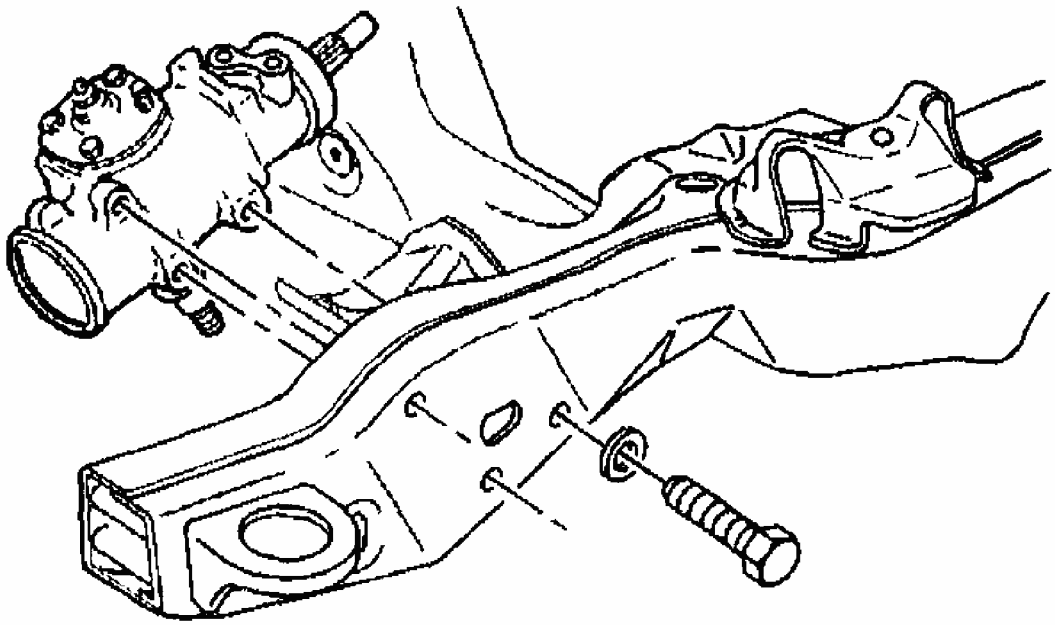

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Fig. 127: Removing Steering Gear Mounting Bolts & Washers From Frame
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

1. Install the steering gear.

   NOTE: Refer to FASTENER NOTICE in Cautions and Notices.

2. Install the power steering gear to the frame washers and the mounting bolts.

   Tighten

   Tighten the power steering gear to frame mounting bolts to 75 N.m (55 lb ft).

3. Install the pitman arm. Refer to **PITMAN ARM REPLACEMENT (RWD)** or **PITMAN ARM REPLACEMENT (4WD)** in Steering Linkage.

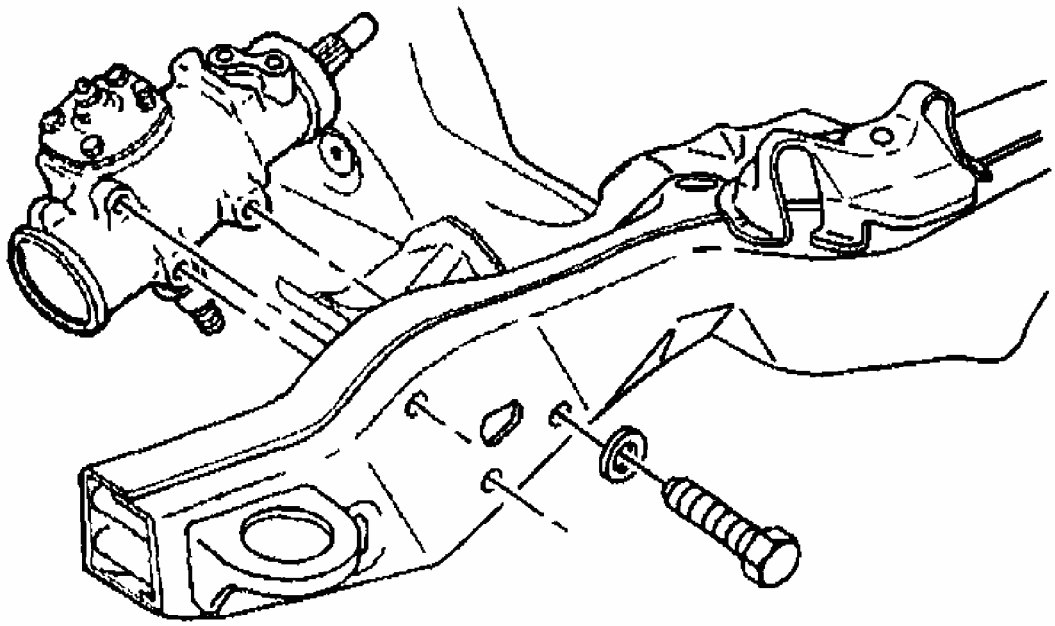

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Fig. 128: Installing Power Steering Gear To Frame Washers & Mounting Bolts
Courtesy of GENERAL MOTORS CORP.

4. Install the lower intermediate shaft to the power steering gear.

   Ensure that the alignment marks line up.

5. Install the lower intermediate shaft coupling bolt.

   Tighten

   Tighten the lower intermediate shaft coupling bolt to 35 N.m (26 lb ft).

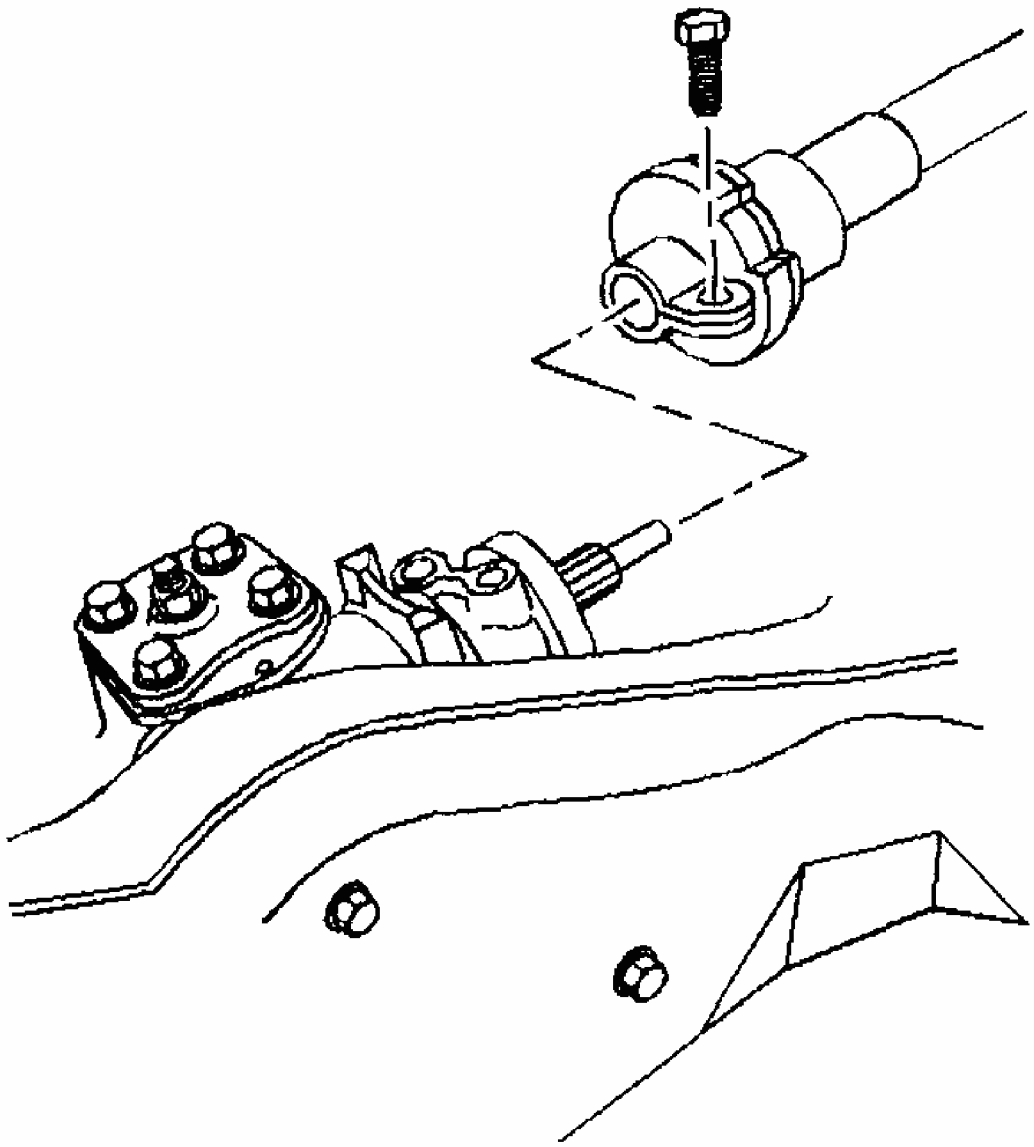

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Fig. 129: Installing Lower Intermediate Shaft To Power Steering Gear
Courtesy of GENERAL MOTORS CORP.

6. Install the pressure and the return hoses to the power steering gear.

   Tighten

   Tighten the pressure hose to 25 N.m (18 lb ft) for the vehicle equipped with the 2.2L engines.

Tighten the return hose to 25 N.m (18 lb ft).

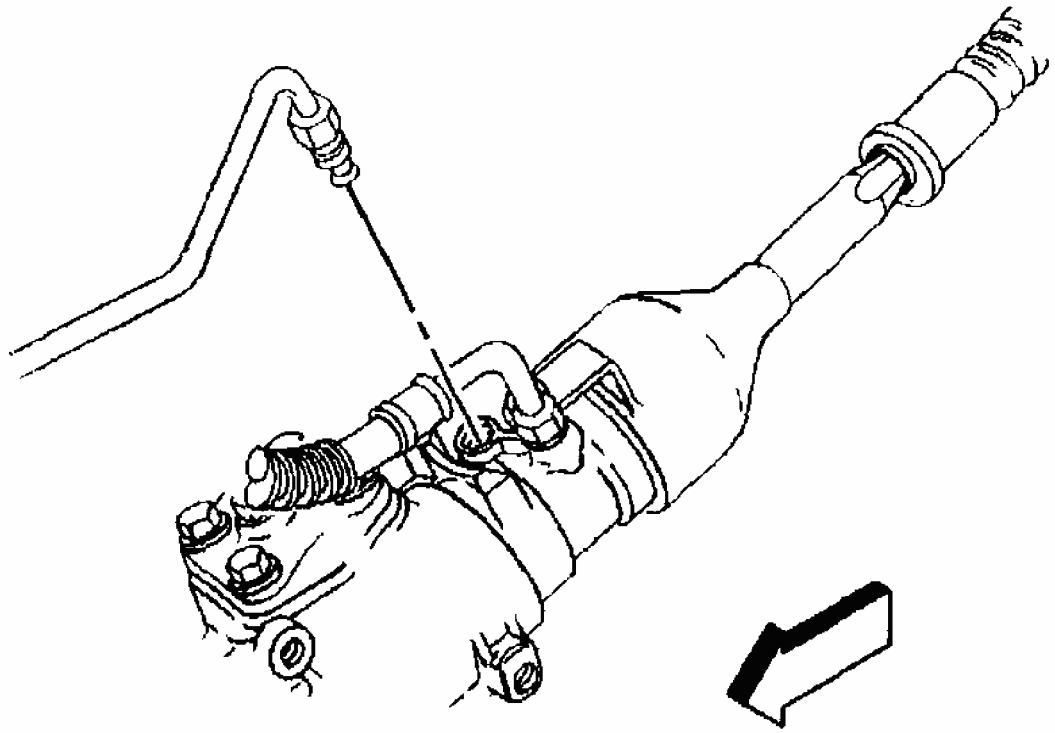

Fig. 130: Installing Pressure & Return Hoses To Power Steering Gear
Courtesy of GENERAL MOTORS CORP.

7. Install the intermediate shaft shield to the power steering gear.
8. Install the air cleaner assembly. Refer to AIR CLEANER OUTLET RESONATOR REPLACEMENT in Engine Controls 2.2L or AIR CLEANER ASSEMBLY REPLACEMENT Engine Controls 4.3L.

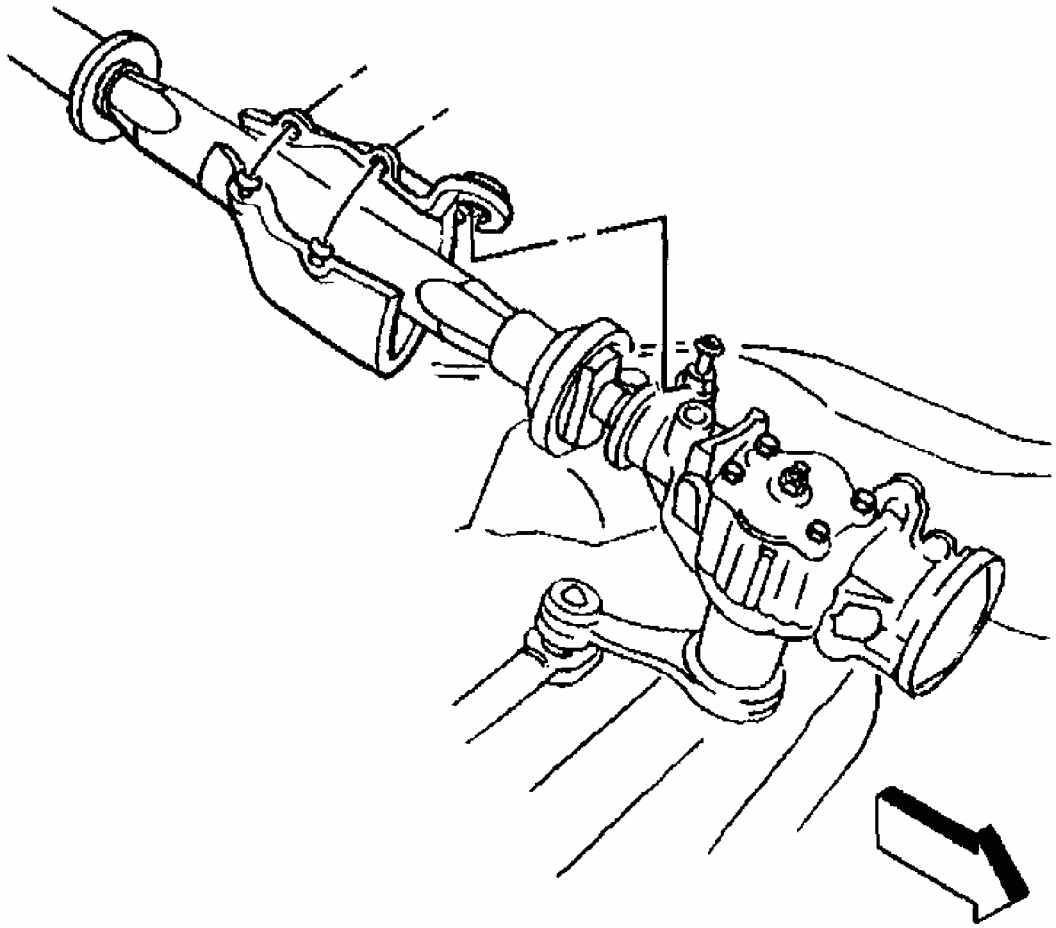

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Fig. 131: Installing Intermediate Shaft Shield To Power Steering Gear
Courtesy of GENERAL MOTORS CORP.

9. Unlock the steering column by removing the *J 42640* from the steering column lower steering column trim cover access hole.
10. Bleed the power steering system. Refer to **BLEEDING THE POWER STEERING SYSTEM** .

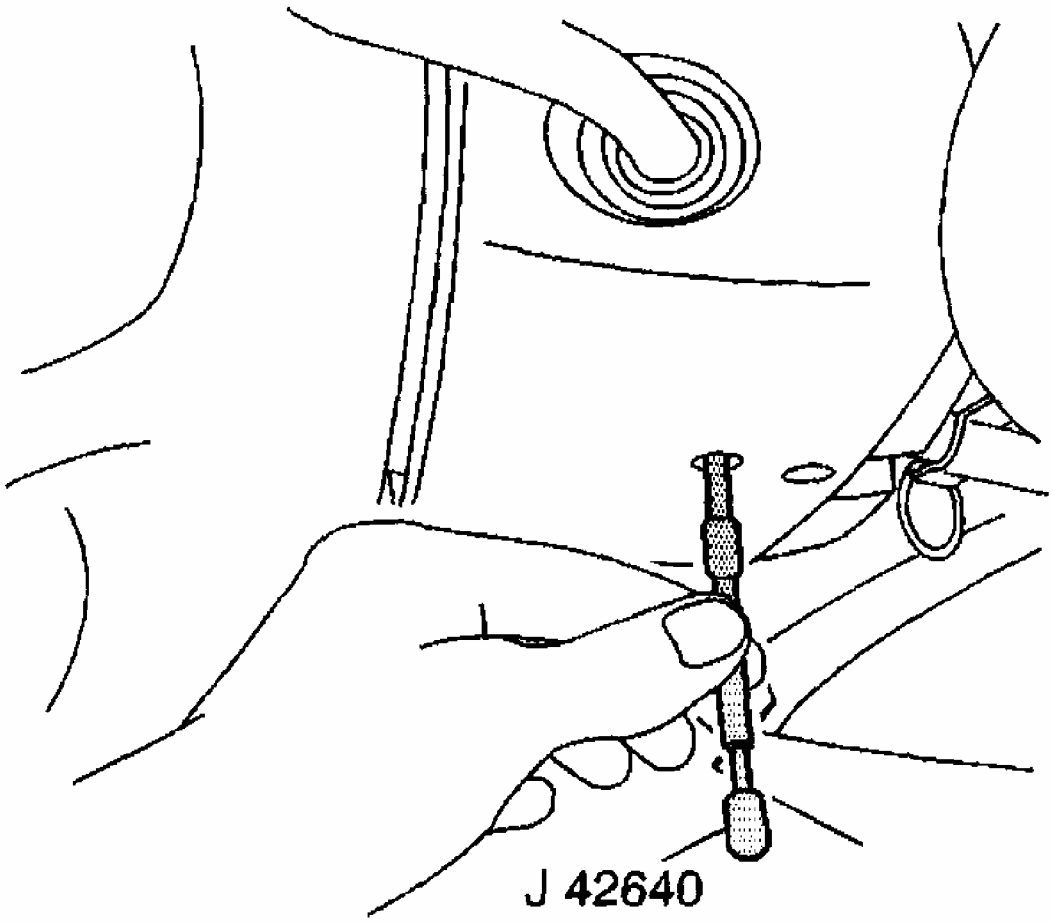

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Fig. 132: Unlocking Steering Column Using Steering Column Anti-Rotation Pin
Courtesy of GENERAL MOTORS CORP.

POWER STEERING GEAR REPLACEMENT (4WD)

Tools Required

- *J 24319-B* Steering Linkage and Tie Rod Puller
- *J 42640* Steering Column Anti-Rotation Pin
- *J 29193* Steering Linkage Installer (12 mm)
- *J 29194* Steering Linkage Installer (14 mm)

Removal Procedure

NOTE: Do not rotate steering shaft after steering column has been removed. Damage to SIR components may occur.

1. Lock the steering column through the access hole in the steering column lower trim cover using *J 42640* .
2. Remove the air cleaner assembly. Refer to AIR CLEANER ASSEMBLY REPLACEMENT in Engine Controls 4.3L.

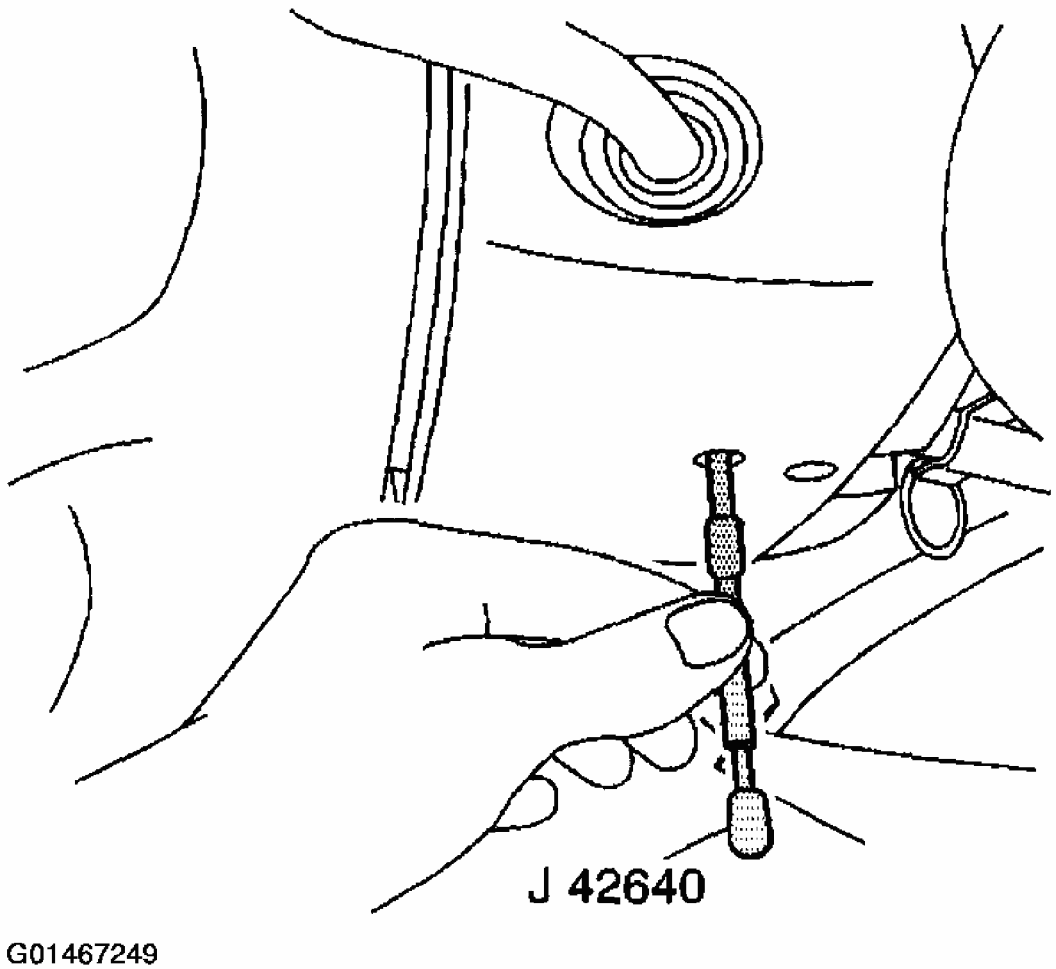

Fig. 133: Locking Steering Column Using Steering Column Anti-Rotation Pin
Courtesy of GENERAL MOTORS CORP.

3. Remove the intermediate shaft shield from the steering gear.

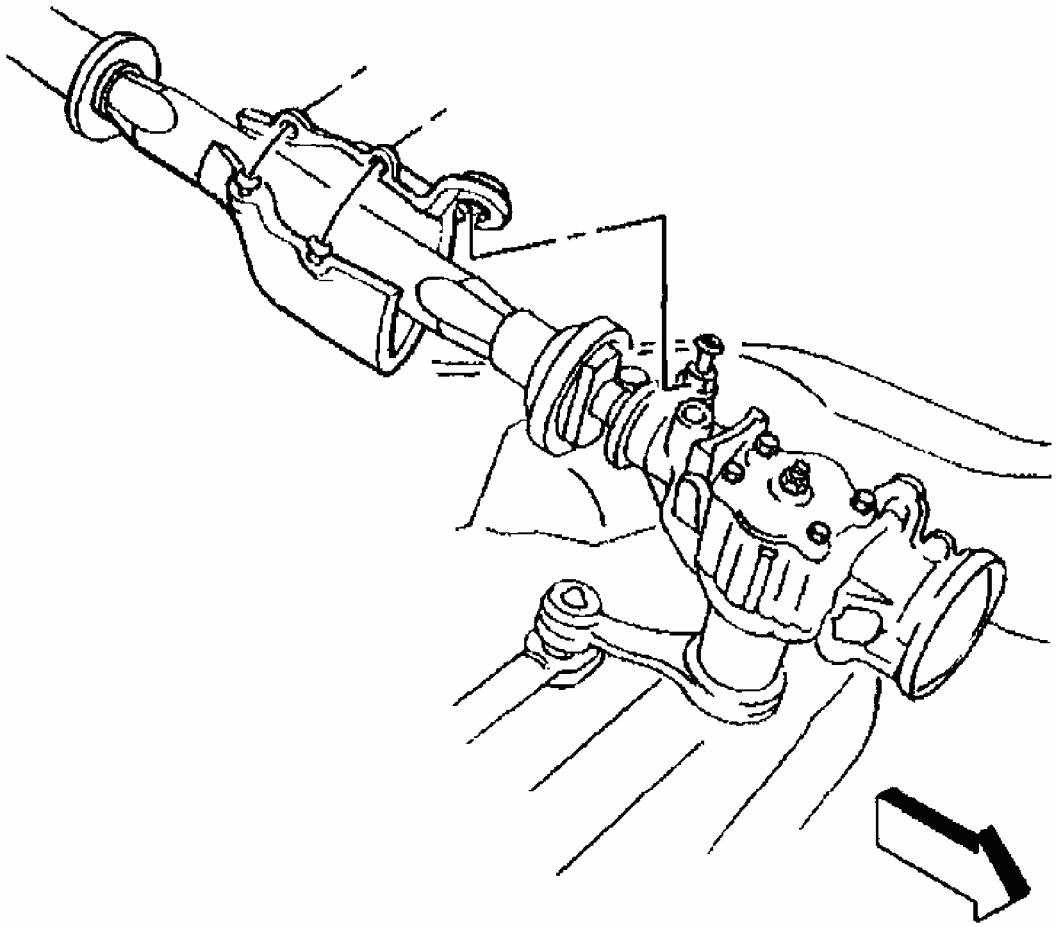

Fig. 134: Removing Intermediate Shaft Shield From Steering Gear
Courtesy of GENERAL MOTORS CORP.

4. Place a drain pan below the steering gear.
5. Disconnect the wiring harness clip from the power steering return hose at the power steering gear.
6. Remove the pressure and the return hoses from the power steering gear.

   Cap or tape the ends of the hoses and the gear fittings in order to prevent dirt from entering the system.

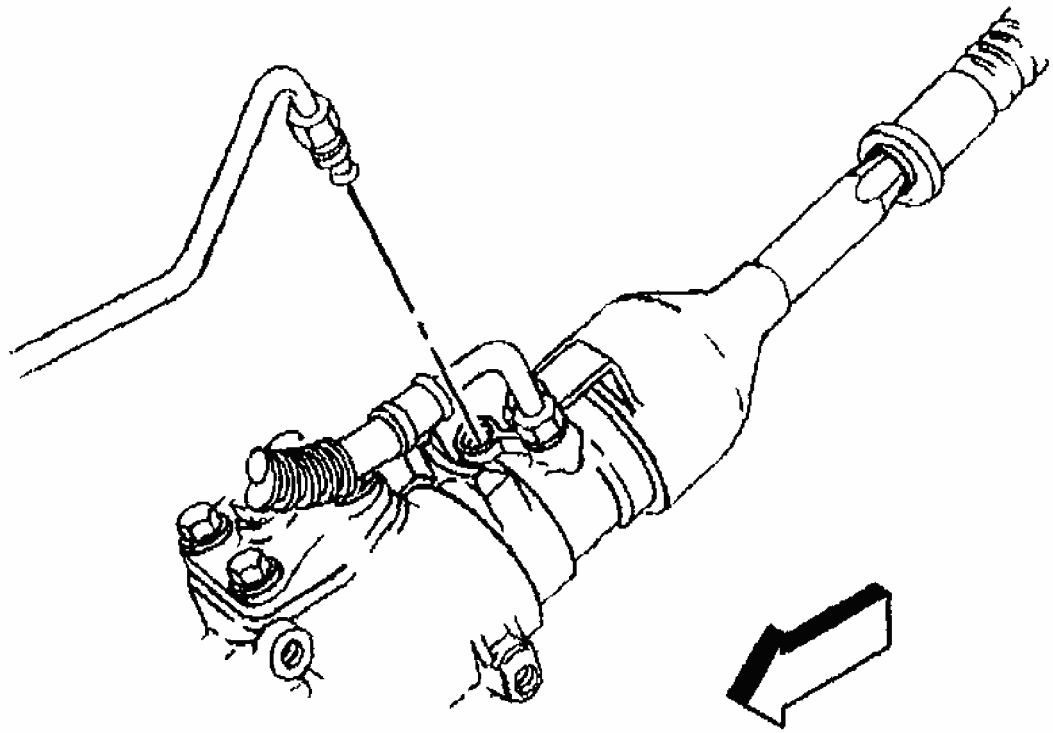

Fig. 135: Removing Pressure & Return Hoses From Power Steering Gear
Courtesy of GENERAL MOTORS CORP.

7. Remove the lower intermediate shaft coupling bolt.
8. Draw alignment marks on the lower intermediate shaft coupling and the steering shaft.
9. Remove the lower intermediate shaft coupling from the steering shaft.
10. Raise the vehicle. Refer to **LIFTING AND JACKING THE VEHICLE** in General Information.
11. Remove the steering linkage shield. Refer to **STEERING LINKAGE SHIELD REPLACEMENT** in Steering Linkage.

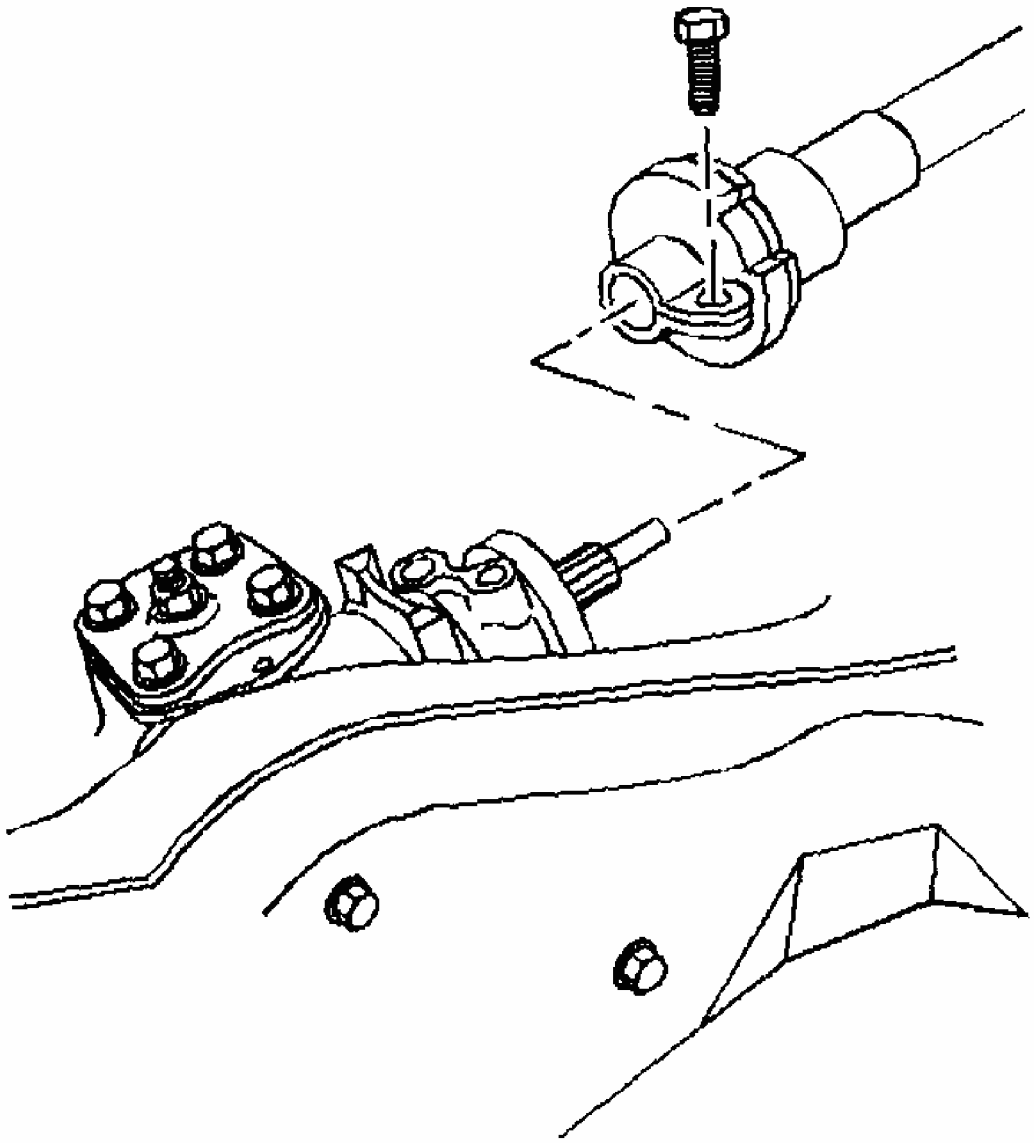

Fig. 136: Removing Lower Intermediate Shaft Coupling From Steering Shaft
Courtesy of GENERAL MOTORS CORP.

12. Remove differential carrier shield mounting bolts.
13. Remove the differential carrier shield.

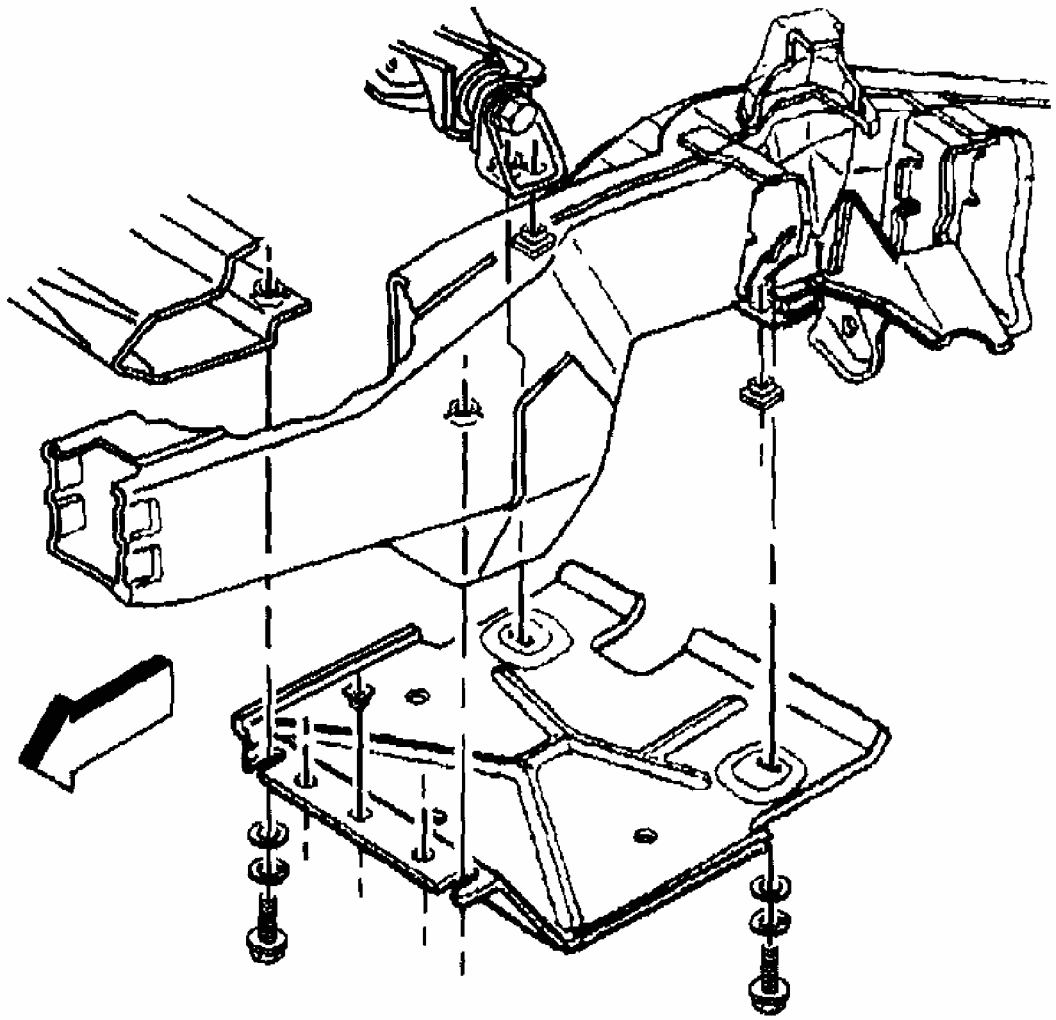

Fig. 137: Differential Carrier Shield Mounting Bolts
Courtesy of GENERAL MOTORS CORP.

14. Remove the pitman arm ball stud cotter pin and nut at the relay rod.

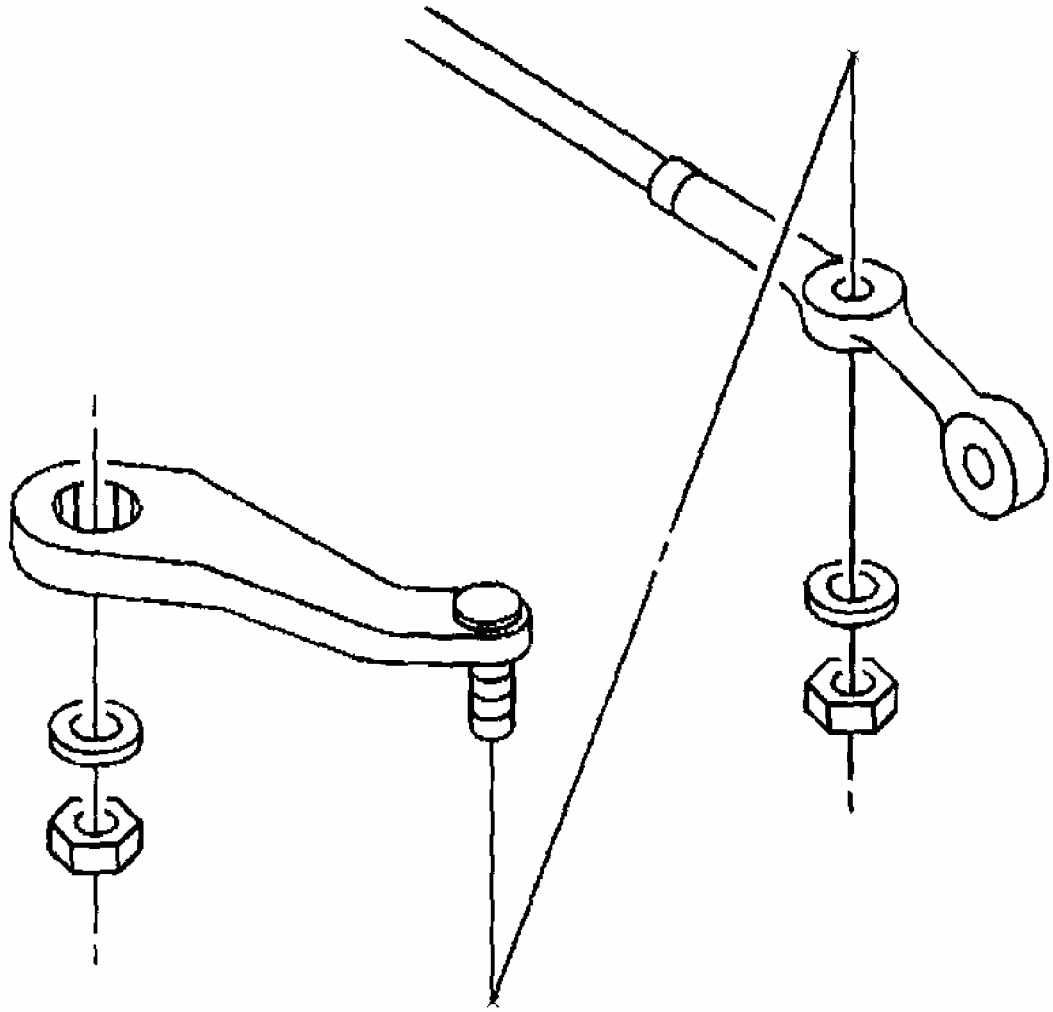

Fig. 138: Removing Pitman Arm Ball Stud Cotter Pin & Nut At Relay Rod
Courtesy of GENERAL MOTORS CORP.

15. Disconnect pitman arm from relay rod using *J 24319-B* .

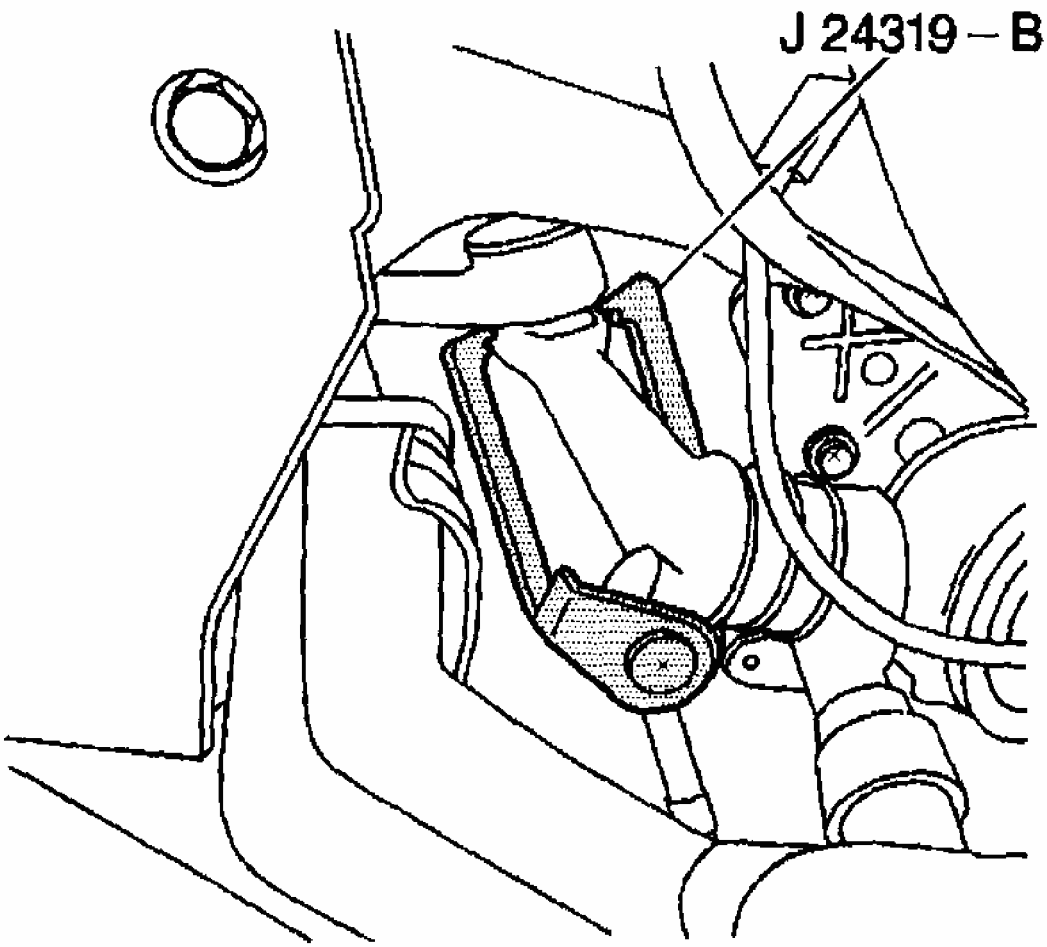

Fig. 139: Disconnecting Pitman Arm From Relay Rod
Courtesy of GENERAL MOTORS CORP.

16. Remove the steering gear mounting bolts and the washers from the frame.
17. Remove the steering gear.
18. Remove the pitman arm. Refer to **PITMAN ARM REPLACEMENT (RWD)** or **PITMAN ARM REPLACEMENT (4WD)** in Steering Linkage.

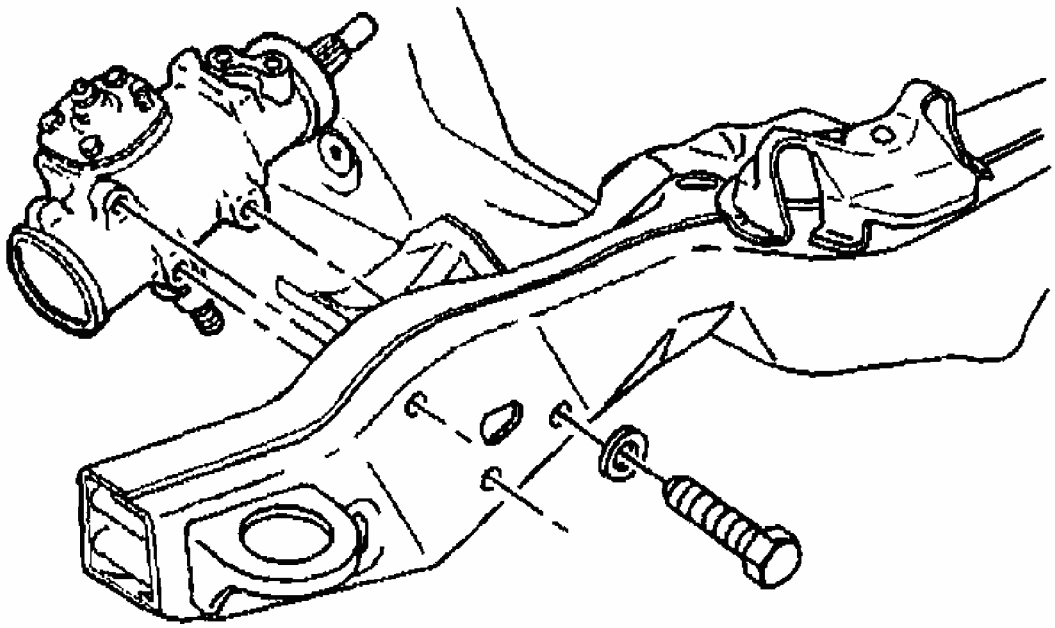

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Fig. 140: Removing Steering Gear Mounting Bolts & Washers From Frame
Courtesy of GENERAL MOTORS CORP.

Installation Procedure

1. Install the pitman arm. Refer to **PITMAN ARM REPLACEMENT (RWD)** or **PITMAN ARM REPLACEMENT (4WD)** in Steering Linkage.
2. Install the steering gear.

NOTE: Refer to FASTENER NOTICE in Cautions and Notices.

3. Install the power steering gear to the frame washers and mounting bolts.

Tighten

Tighten the power steering gear to frame mounting bolts to 75 N.m (55 lb ft).

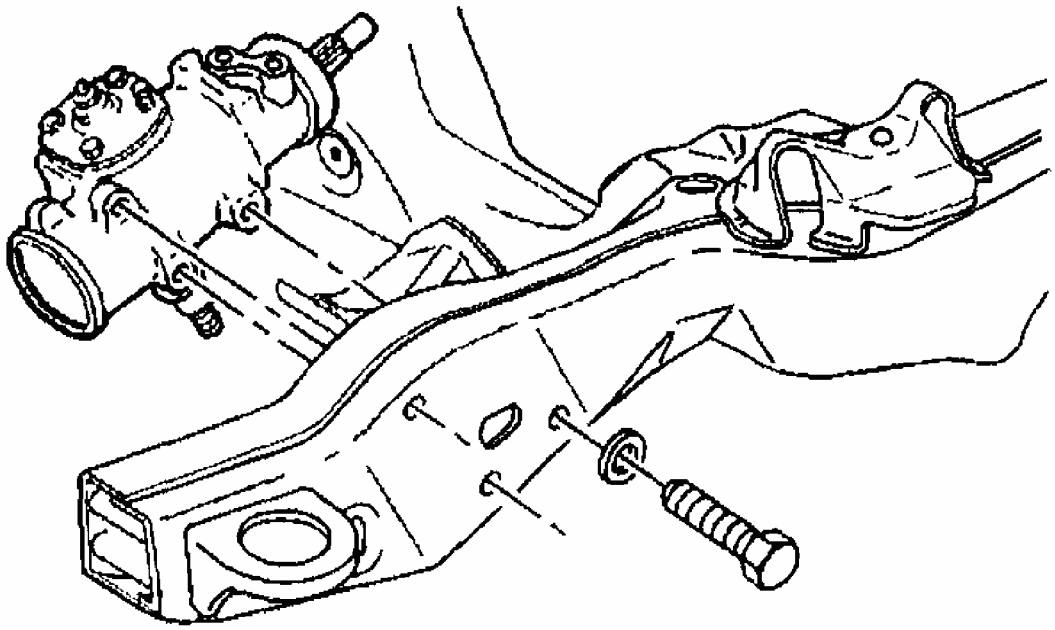

Fig. 141: Installing Power Steering Gear To Frame Washers & Mounting Bolts
Courtesy of GENERAL MOTORS CORP.

4. Connect the relay rod to the pitman arm ball stud. Ensure the seal is on the stud.
5. Seat the taper using *J 29193* or *J 29194* .

Tighten

Tighten *J 29193* or *J 29194* to 62 N.m (48 lb ft).

6. Remove *J 29193* or *J 29194* from the pitman arm ball stud.
7. Install the new nut and cotter pin to the pitman arm ball stud at the relay rod.

Tighten

Tighten the pitman arm ball stud nut at the relay rod to 83 N.m (61 lb ft).

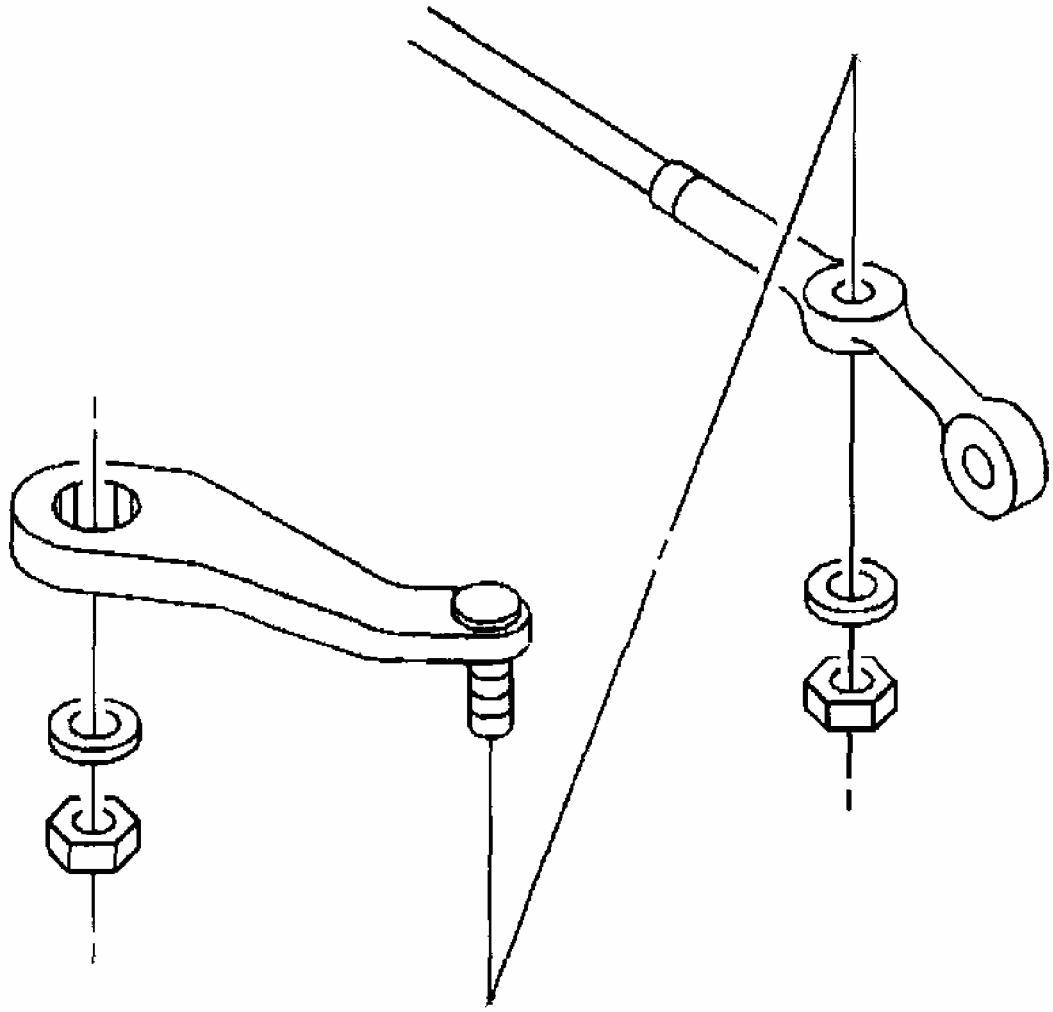

Fig. 142: Installing New Nut & Cotter Pin To Pitman Arm Ball Stud At Relay Rod
Courtesy of GENERAL MOTORS CORP.

8. Install differential carrier shield.
9. Install the differential carrier shield mounting bolts.

   Tighten

   Tighten the bolts to 25 N.m (18 lb ft).

10. Install the steering linkage shield. Refer to **STEERING LINKAGE SHIELD REPLACEMENT** in Steering Linkage.
11. Lower the vehicle.

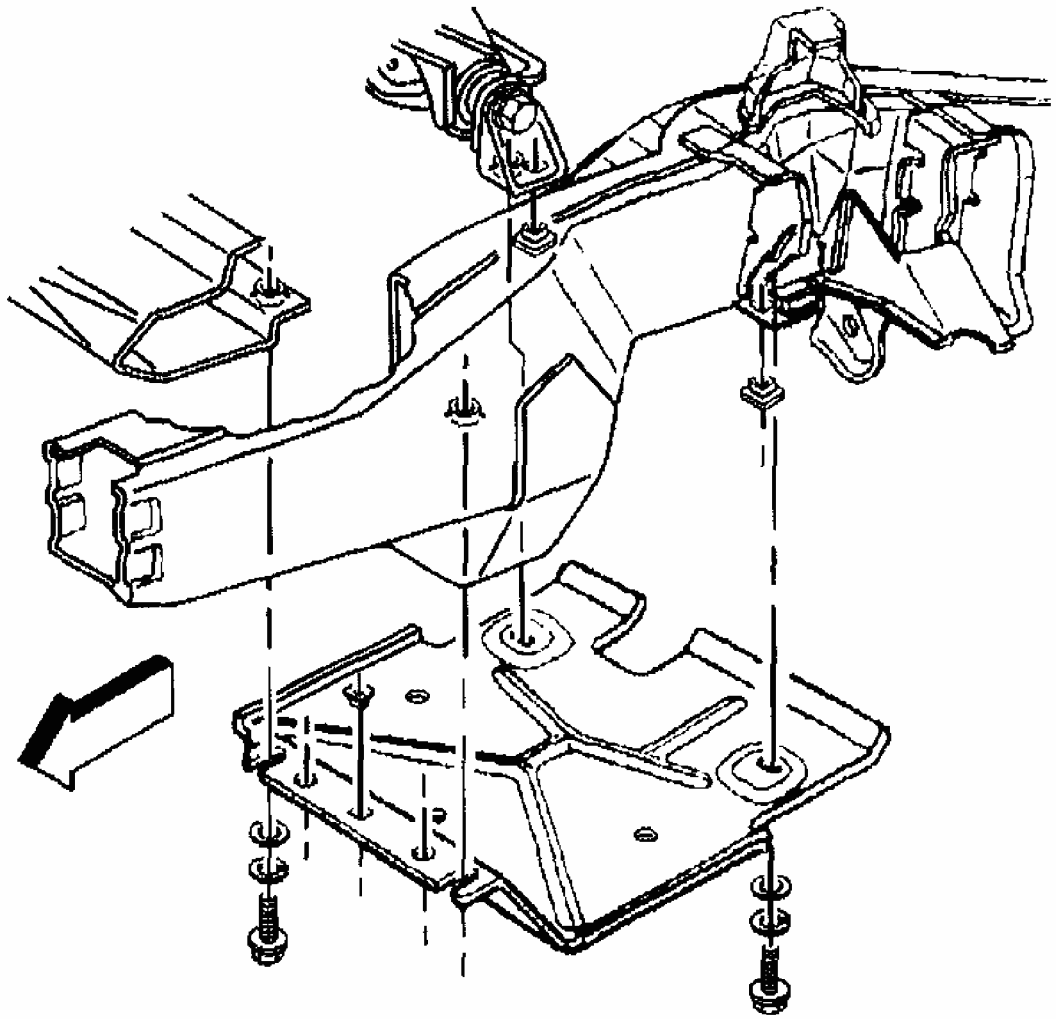

Fig. 143: Differential Carrier Shield Mounting Bolts
Courtesy of GENERAL MOTORS CORP.

12. Install the lower intermediate shaft to the power steering gear.
13. Ensure that the alignment marks line up.
14. Install the lower intermediate shaft coupling bolt.

Tighten

Tighten the lower intermediate shaft coupling bolt to 35 N.m (26 lb ft).

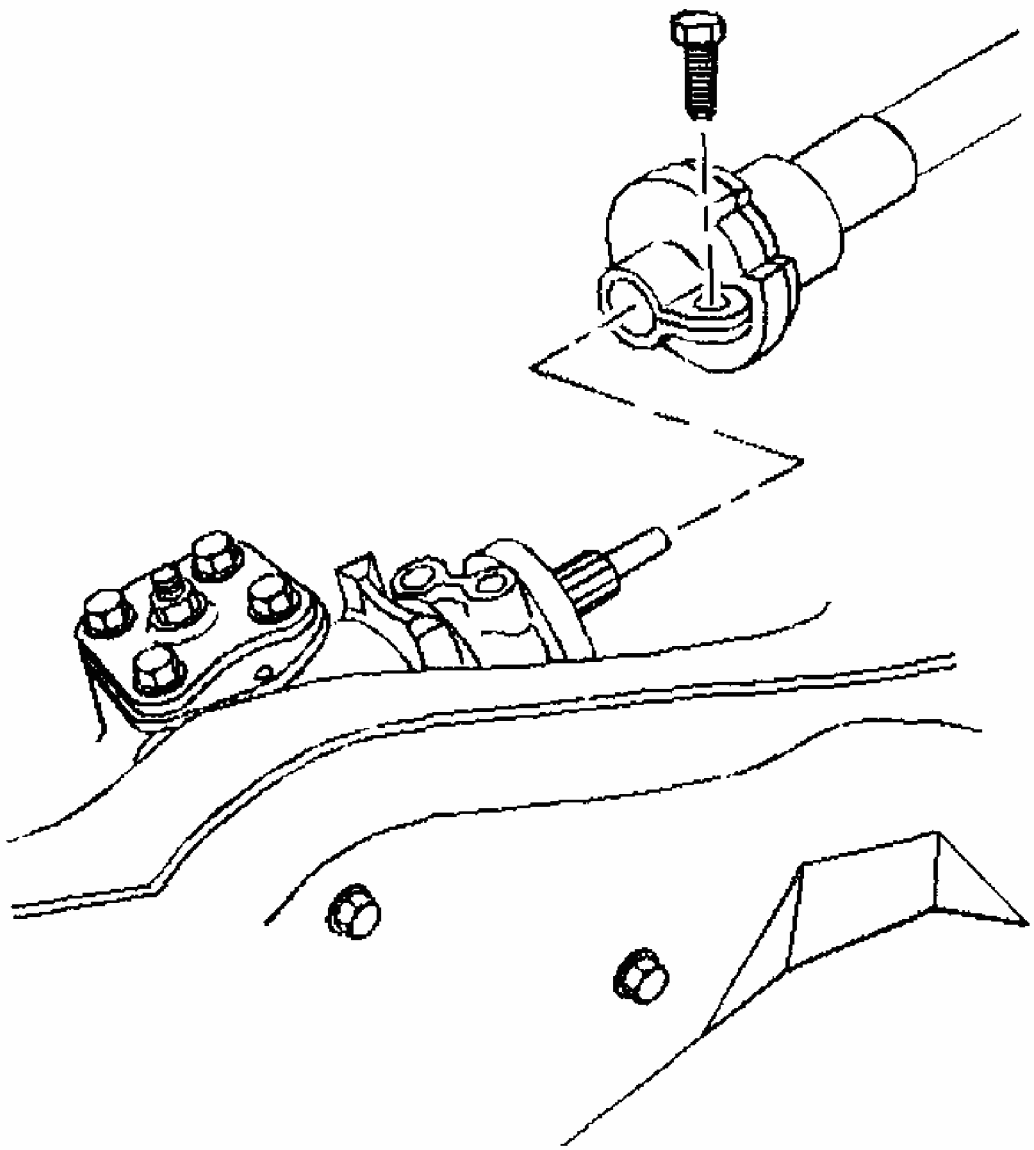

Fig. 144: Installing Lower Intermediate Shaft To Power Steering Gear
Courtesy of GENERAL MOTORS CORP.

15. Install the pressure and return hoses to the power steering gear.

    Tighten

    Tighten the pressure hose to 30 N.m (22 lb ft).

16. Connect the wiring harness clip to the power steering return hose at the power steering

gear.

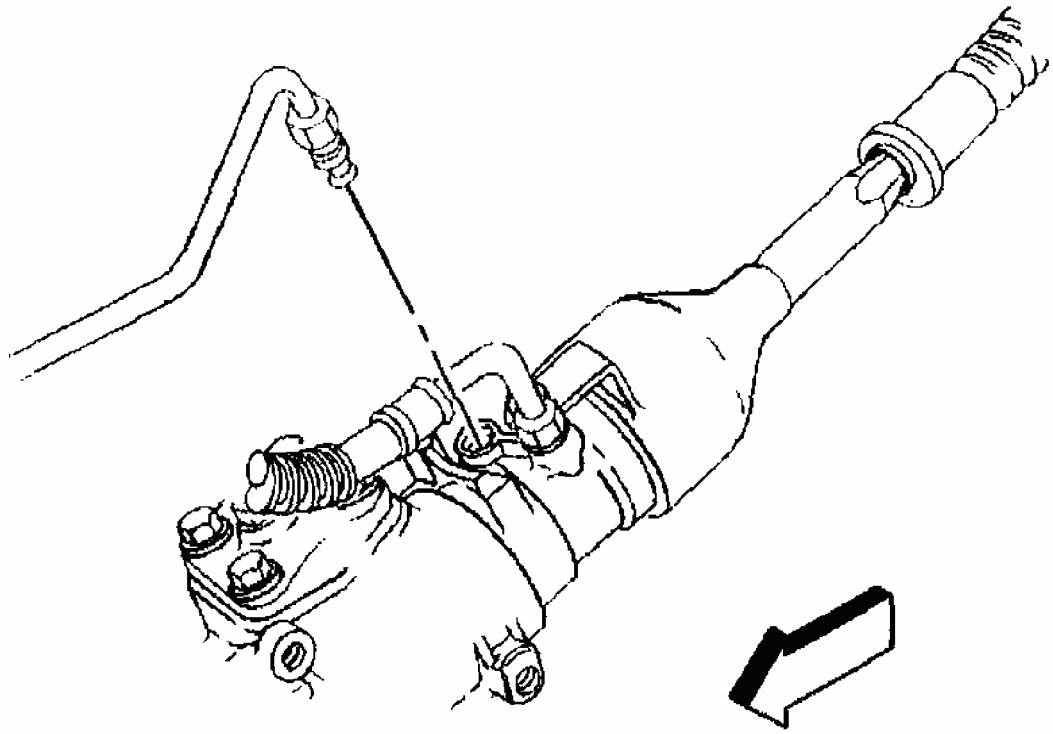

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Fig. 145: Installing Pressure & Return Hoses To Power Steering Gear
Courtesy of GENERAL MOTORS CORP.

17. Install the intermediate shaft shield to the power steering gear.
18. Install the air cleaner assembly. Refer to AIR CLEANER ASSEMBLY REPLACEMENT in Engine Controls 4.3L.

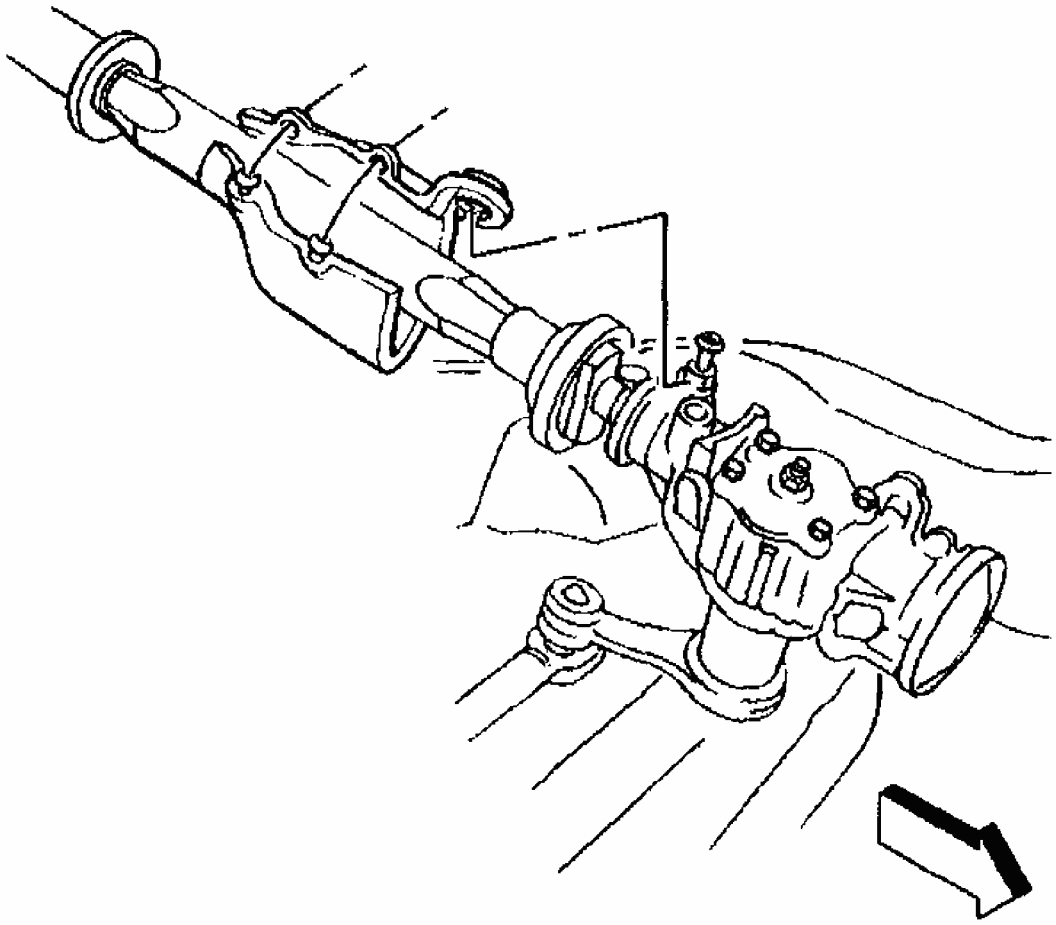

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Fig. 146: Installing Intermediate Shaft Shield To Power Steering Gear
Courtesy of GENERAL MOTORS CORP.

19. Unlock the steering column by removing the *J 42640* from the steering column lower steering column trim cover access hole.
20. Bleed the power steering system. Refer to **BLEEDING THE POWER STEERING SYSTEM** .

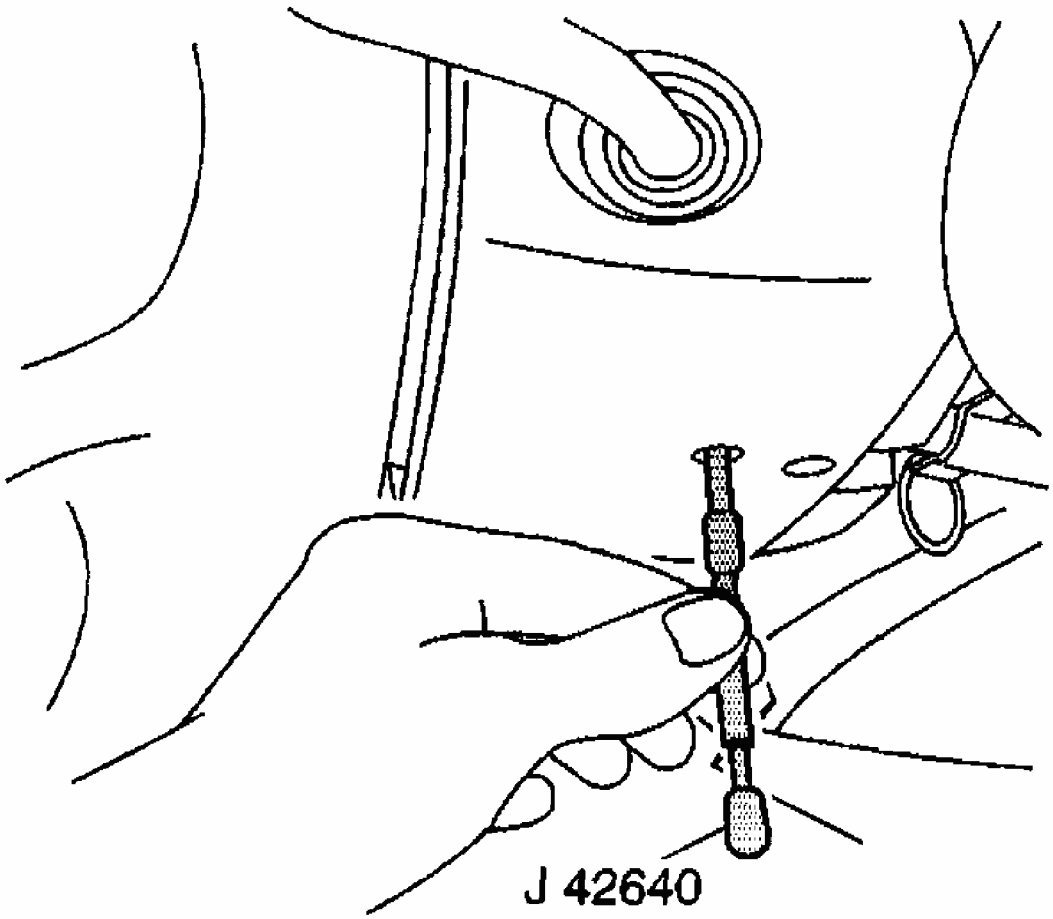

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Fig. 147: Unlocking Steering Column Using Steering Column Anti-Rotation Pin
Courtesy of GENERAL MOTORS CORP.

WORM THRUST BEARING PRELOAD ADJUSTMENT - OFF VEHICLE (700 GEAR)

Tools Required

- *J 42882* Adjuster Nut Socket
- *J 43435* Adjuster Lock Nut Wrench

1. Rotate the stub shaft back and forth in order to drain the power steering fluid.
2. Remove the coupling shield retainer and the lock nut from the steering gear housing using *J 43435* and a torque wrench.

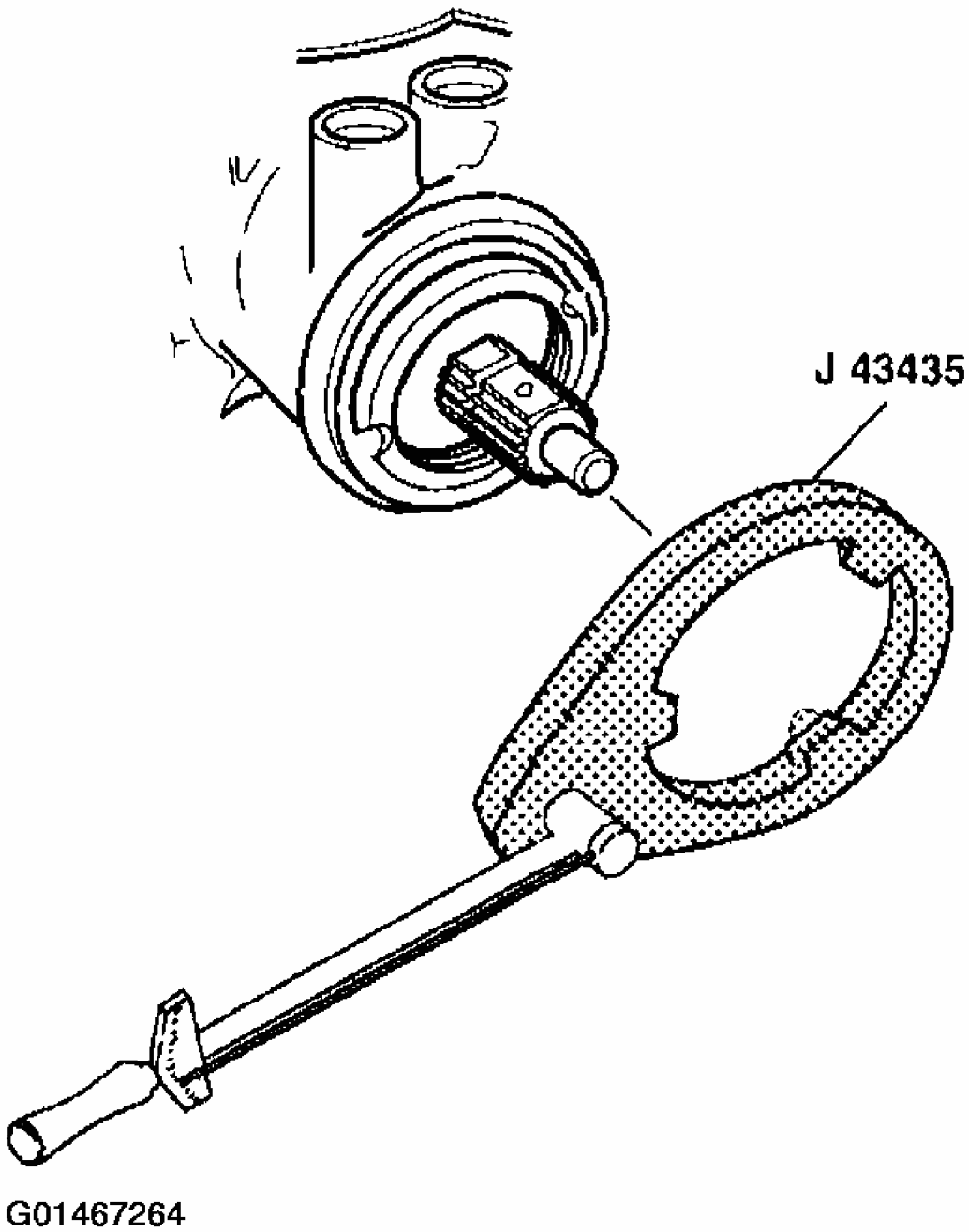

Fig. 148: Removing Coupling Shield Retainer & Lock Nut From Steering Gear Housing
Courtesy of GENERAL MOTORS CORP.

NOTE: Refer to FASTENER NOTICE in Cautions and Notices.

3. Turn the adjuster nut assembly (1) clockwise using *J 42882* until the adjuster nut

assembly (1) and the thrust support assembly (2) are firmly bottomed in the steering gear housing (3).

Tighten

Tighten the adjuster nut assembly (1) to 28-31 N.m (20-23 lb ft).

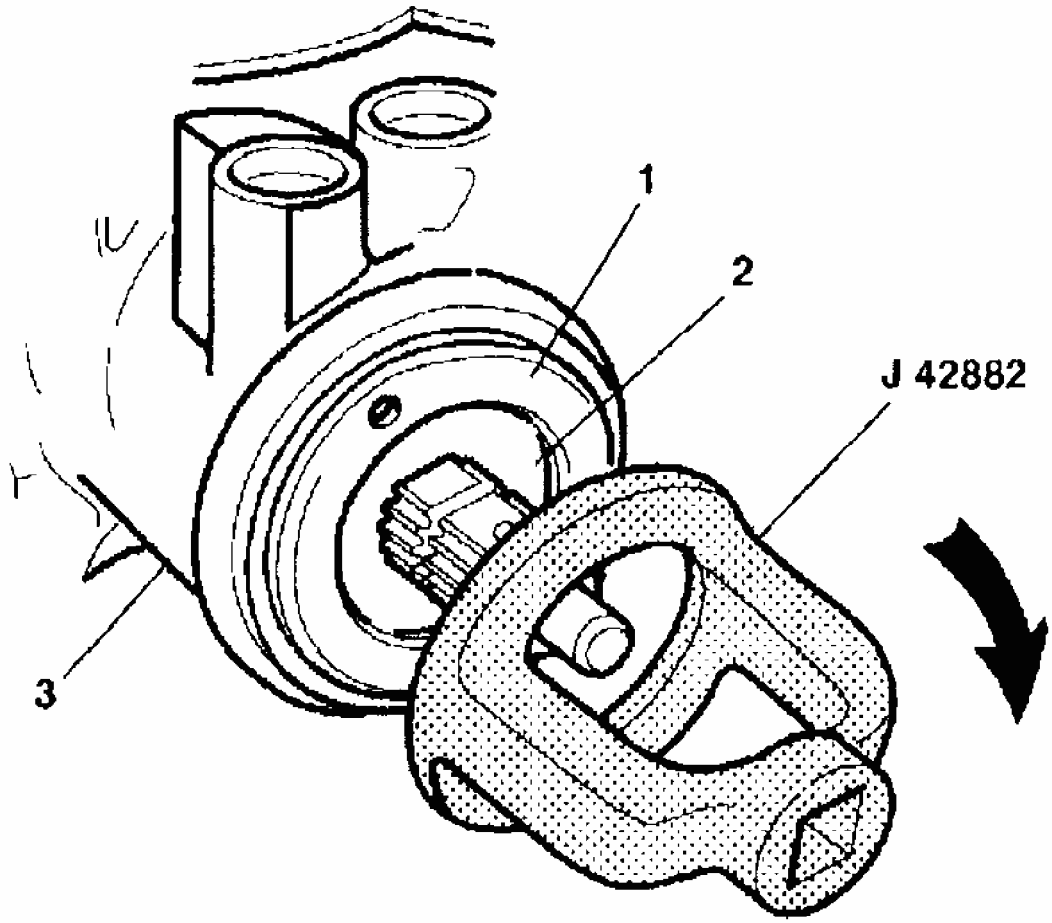

Fig. 149: Turning Adjuster Nut Assembly Clockwise
Courtesy of GENERAL MOTORS CORP.

4. Place an index mark (1) on the steering gear housing (4) parallel with one of the holes (3) in the adjuster nut assembly (2).

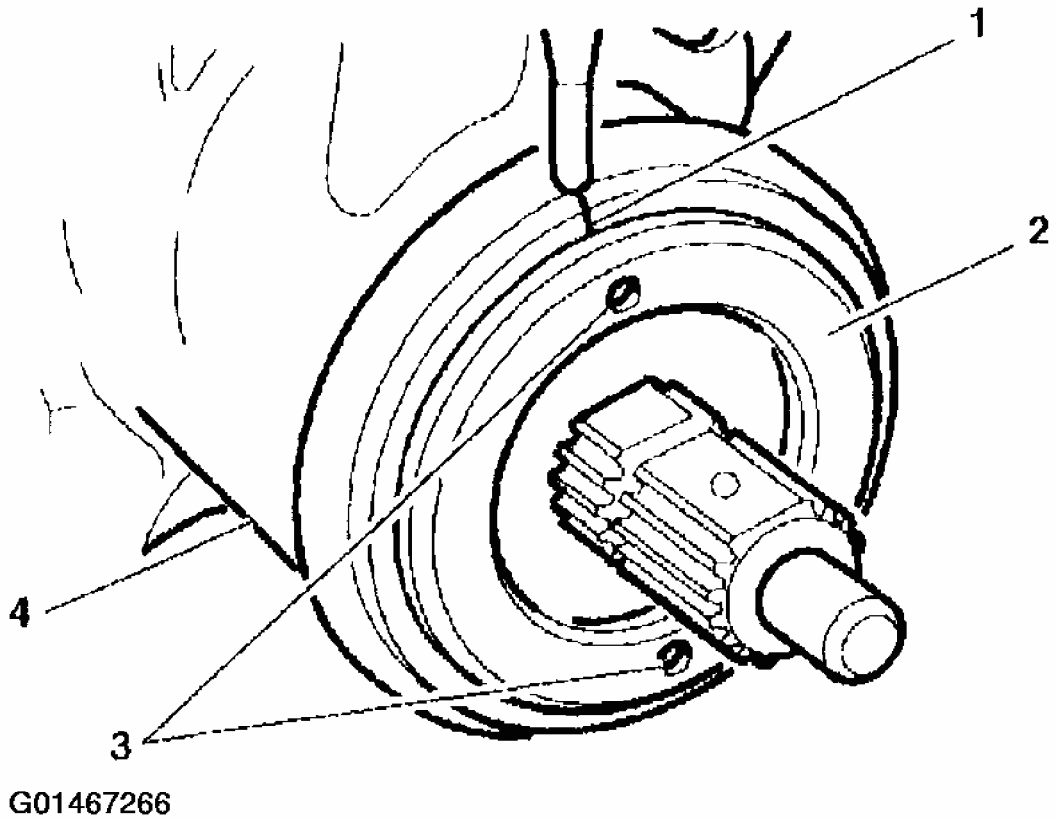

Fig. 150: Placing Index Mark On Steering Gear Housing
Courtesy of GENERAL MOTORS CORP.

5. Measure back counterclockwise 13 mm (1/2 in).
6. Place a second mark (2) on the steering gear housing (1).

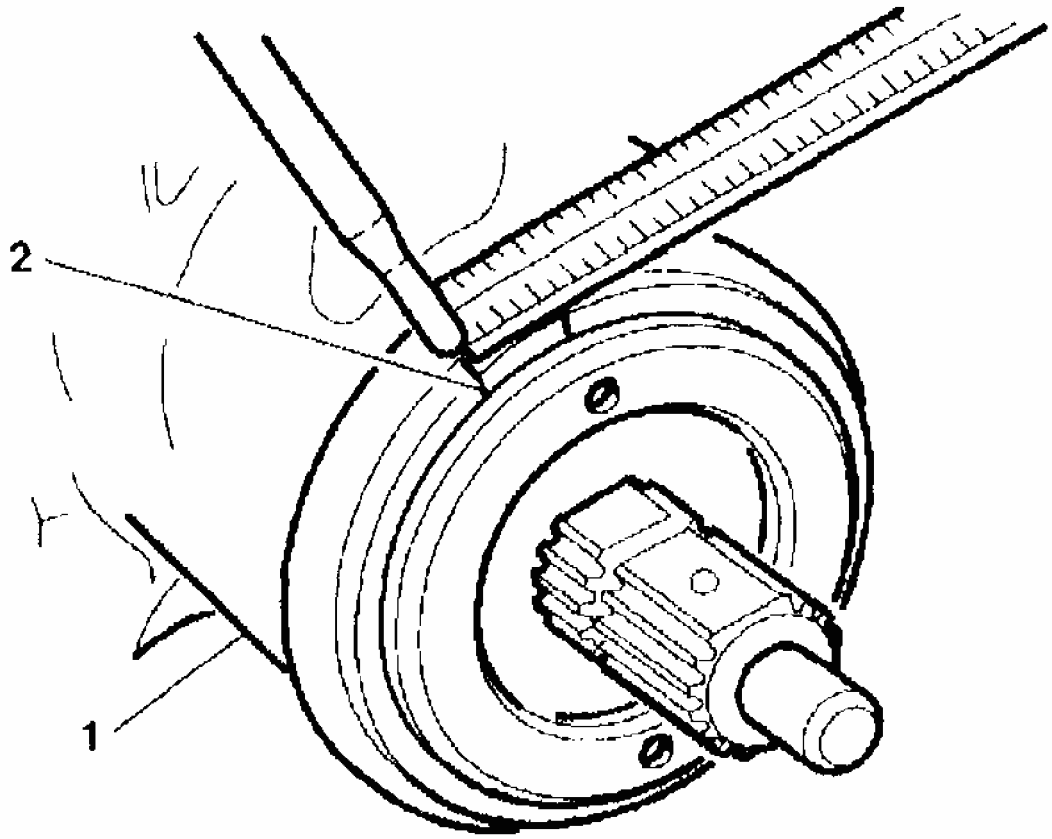

Fig. 151: Measuring Backlash & Placing Second Mark On Steering Gear Housing
Courtesy of GENERAL MOTORS CORP.

7. Using *J 42882* and a torque wrench, turn the adjuster nut assembly (1) counterclockwise 15-25 degrees to align the hole (2) in the adjuster nut assembly (1) with the second mark (4) on the steering gear housing (3).

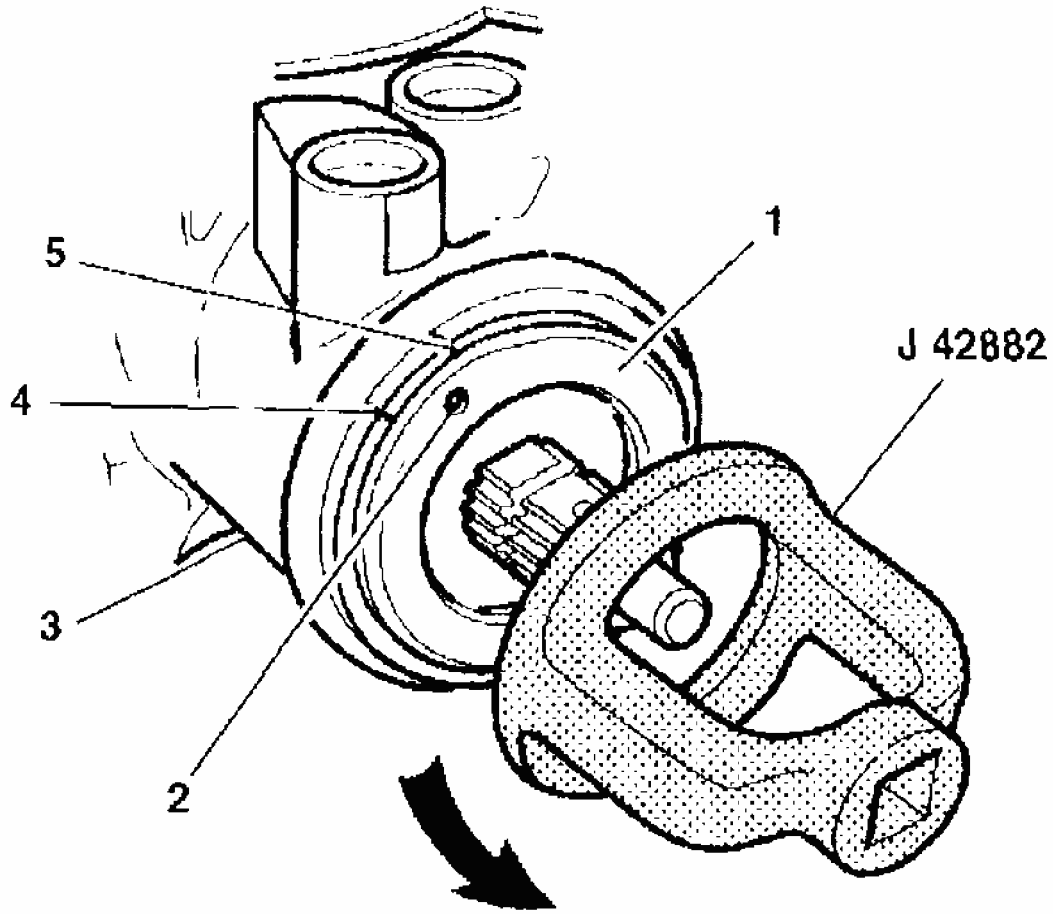

Fig. 152: Turning Adjuster Nut Assembly Counterclockwise
Courtesy of GENERAL MOTORS CORP.

8. Install the coupling shield retainer and the lock nut.
9. Hold the adjuster nut assembly in position to maintain alignment of the marks.
10. Tighten the coupling shield retainer and the lock nut using *J 43435* and a torque wrench.

Tighten

Tighten the coupling shield retainer and the lock nut to 109 N.m (80 lb ft).

11. To adjust the pitman shaft, refer to **PITMAN SHAFT OVER-CENTER PRELOAD ADJUSTMENT - OFF VEHICLE (700 GEAR)** .

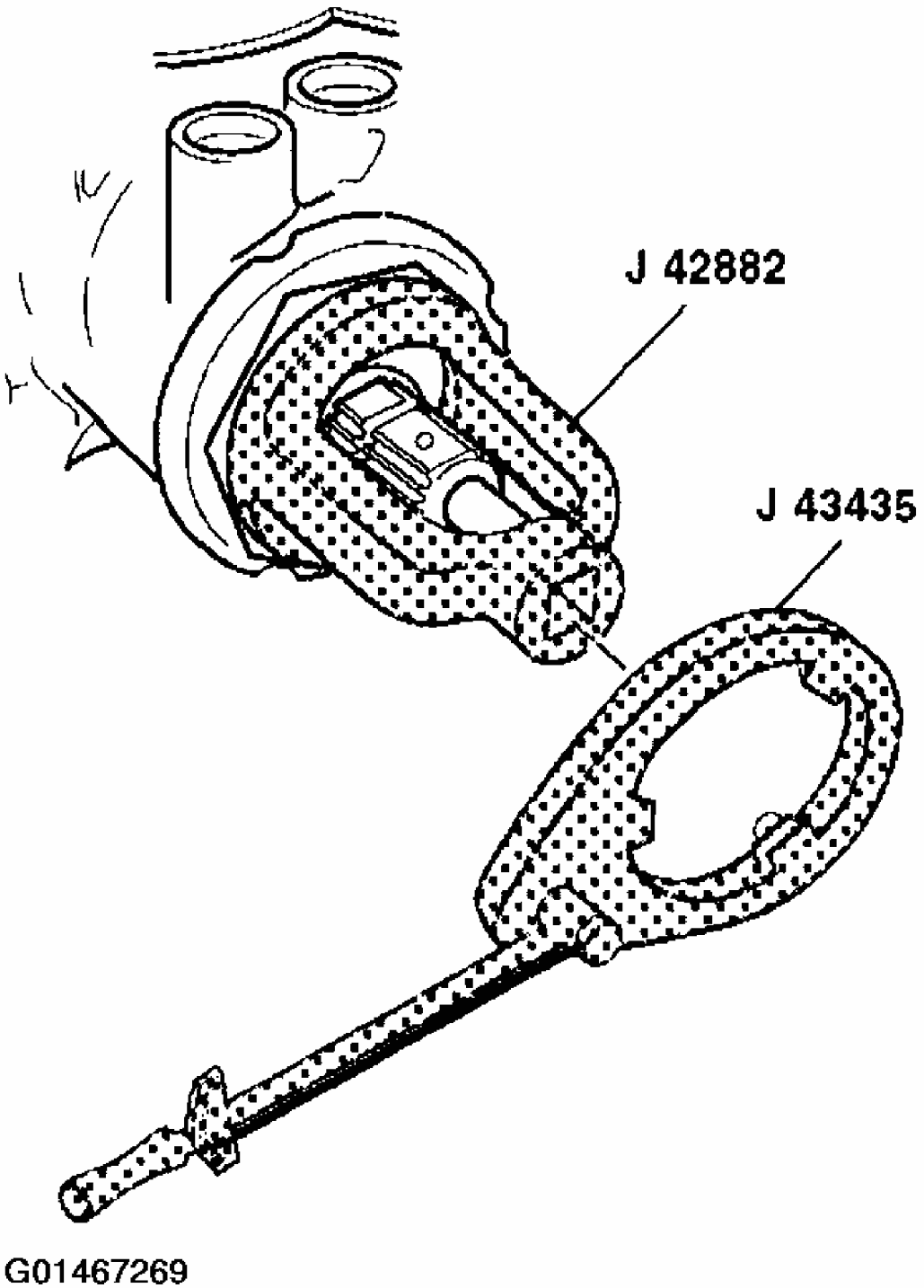

Fig. 153: Tightening Coupling Shield Retainer & Lock Nut
Courtesy of GENERAL MOTORS CORP.

PITMAN SHAFT OVER-CENTER PRELOAD ADJUSTMENT - OFF VEHICLE (700 GEAR)

1. Adjust the worm shaft and valve, refer to: **WORM THRUST BEARING PRELOAD ADJUSTMENT - OFF VEHICLE (700 GEAR)** .
2. Rotate the stub shaft (3) back and forth to drain the power steering fluid.
3. Loosen the adjuster lock nut (4).
4. Turn the pitman shaft adjuster screw (1) counterclockwise until the screw is fully extended.
5. Turn the pitman shaft adjuster screw (1) clockwise 1 full turn.
6. Rotate the stub shaft (3) from stop to stop using a 12-point socket while counting the number of turns.
7. Starting at either stop, turn the stub shaft (3) back half of the total number of turns. This is the center of the gear.

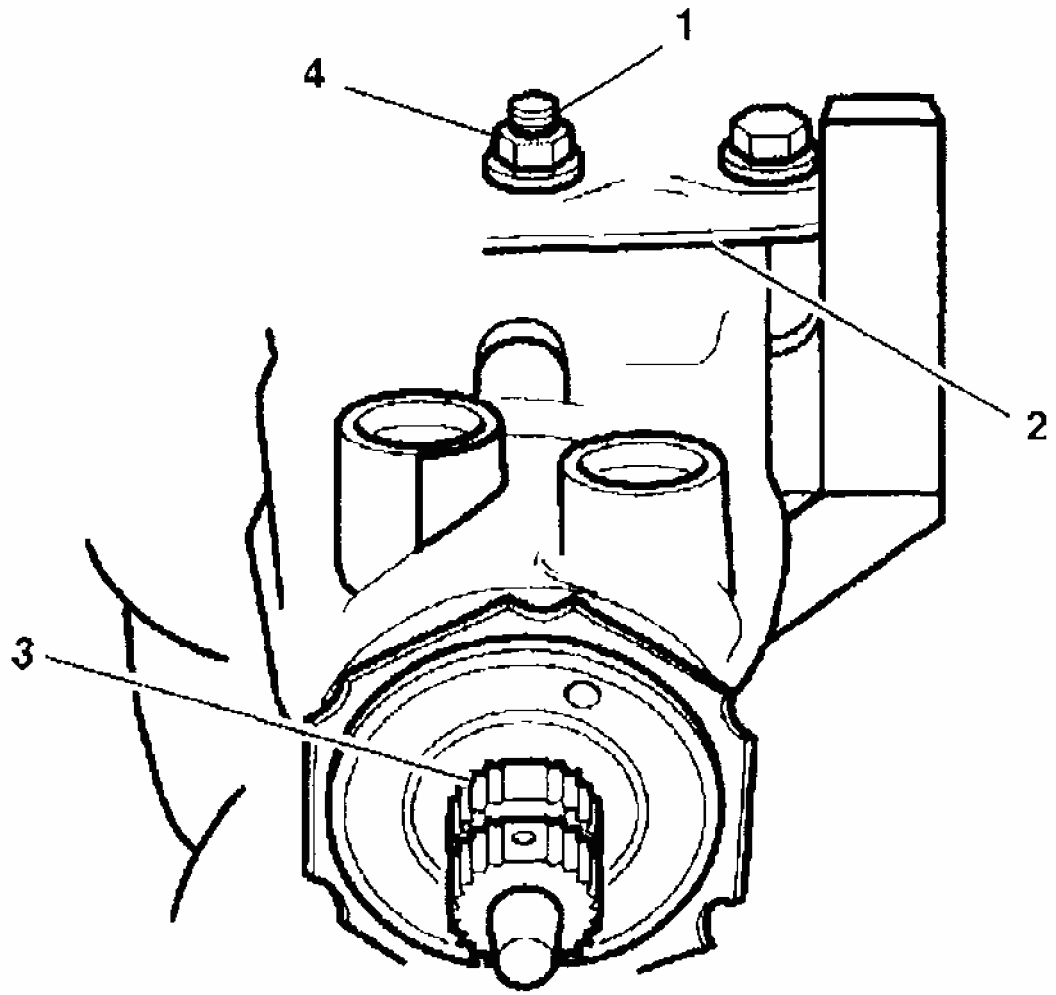

Fig. 154: Identifying Stub Shaft, Adjuster Lock Nut, Adjuster Screws For Over-

Center Preload Adjustment
Courtesy of GENERAL MOTORS CORP.

8. Make sure that the gear is centered by checking the following items:
   - The flat on the stub shaft (3) faces upward.
   - The flat on the stub shaft (3) is parallel with the side cover (2).
9. Align the master spline (5) on the pitman shaft (4) with the adjuster screw (1).

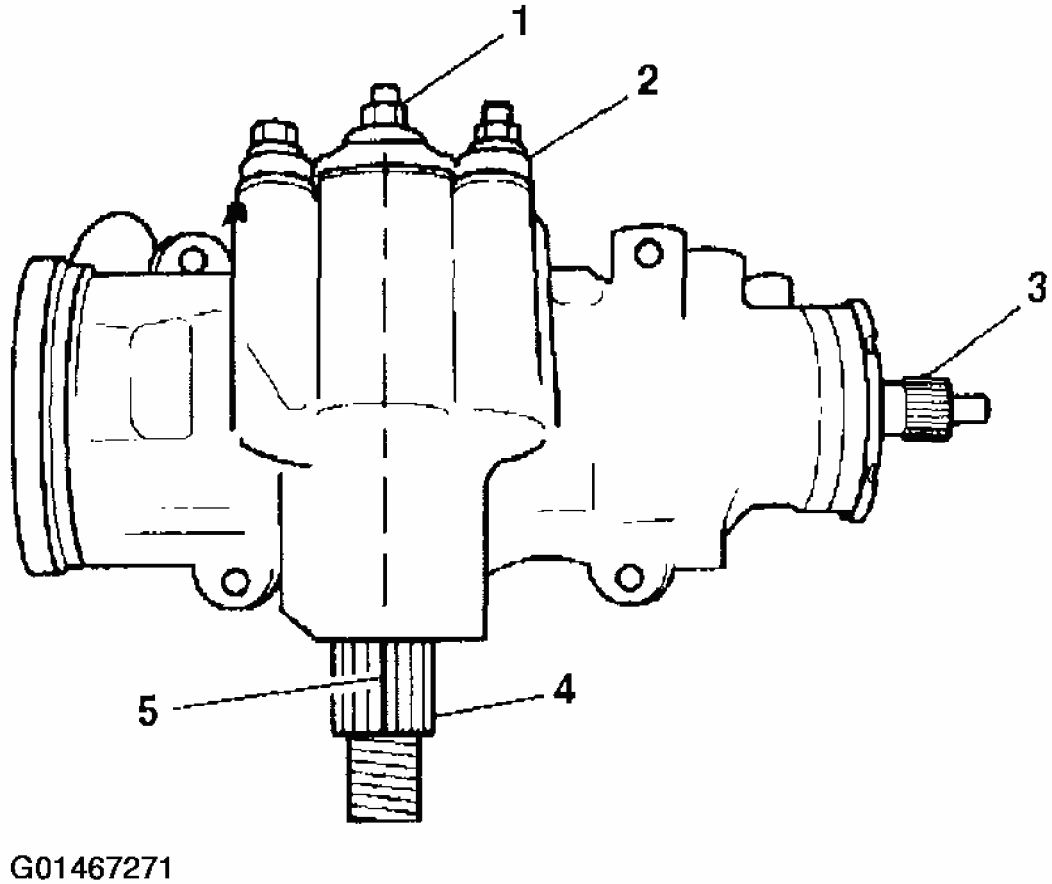

Fig. 155: Checking That Flat On Stub Shaft Faces Upward & Parallel With Side Cover
Courtesy of GENERAL MOTORS CORP.

10. Place a torque wrench on the stub shaft (2) with the handle in the vertical position.
11. Rotate the stub shaft (2) 45 degrees from each side of the center of the stub shaft. The stub shaft (2) must rotate smoothly.
12. Record the worm bearing preload measured on or near the center (1). The recorded bearing preload must be 0.7-1.7 N.m (6-15 lb in) with the worm and the ball nut

installed. If the torque is outside of this range, readjust or repair the steering gear assembly as required.

13. To obtain the correct preload torque, adjust the over-center torque by turning the pitman shaft adjuster screw clockwise.

NOTE: Refer to FASTENER NOTICE in Cautions and Notices.

14. Add 0.7-1.1 N.m (6-10 lb in) torque to the previously measured worm bearing preload torque.

Tighten

Tighten the adjuster lock nut to 49 N.m (36 lb ft). Prevent the adjuster screw from turning while tightening the adjuster lock nut.

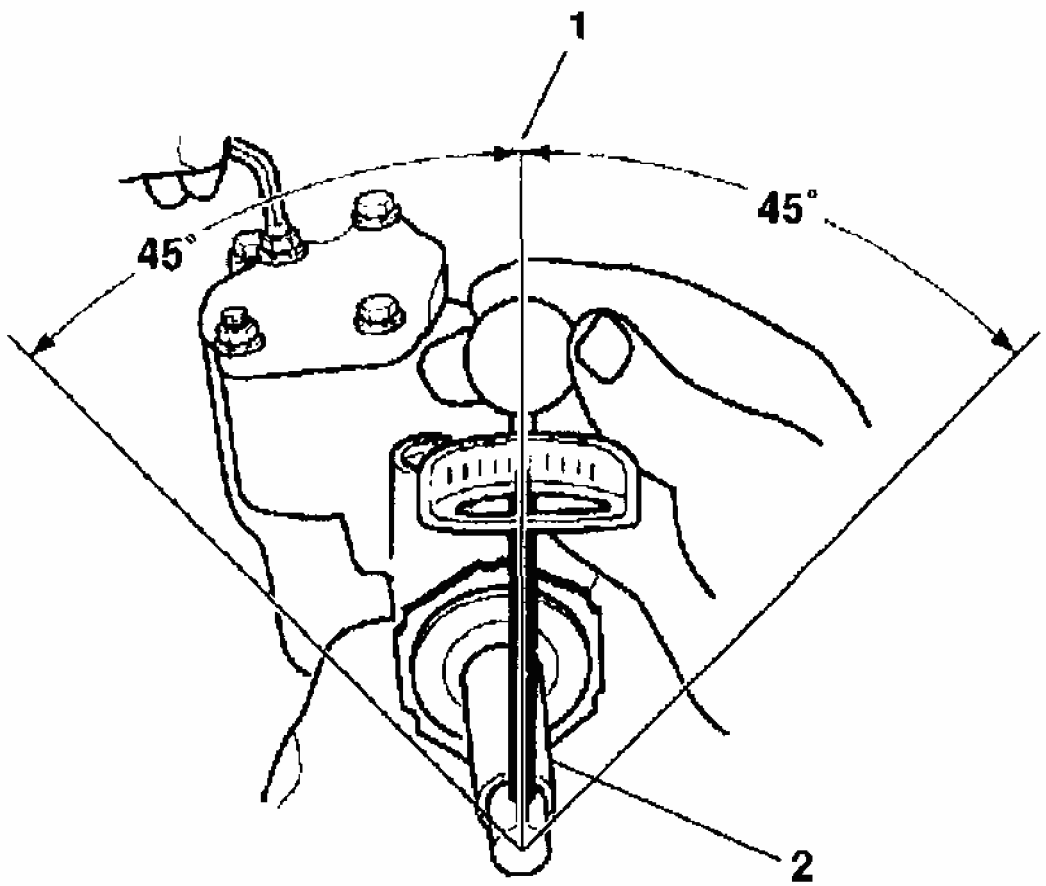

Fig. 156: Recording Worm Bearing Preload Measurement On Or Near Center Of Stub Shaft

Courtesy of GENERAL MOTORS CORP.

STEERING GEAR PITMAN SHAFT AND HOUSING COVER REPLACEMENT - OFF VEHICLE (700 GEAR)

Disassembly Procedure

1. Remove the nut (3).
2. Remove the lock washer (2).
3. Clean the exposed end of the pitman shaft.
4. Clean the steering gear housing (1).
5. Use a wire brush to clean the pitman shaft splines.

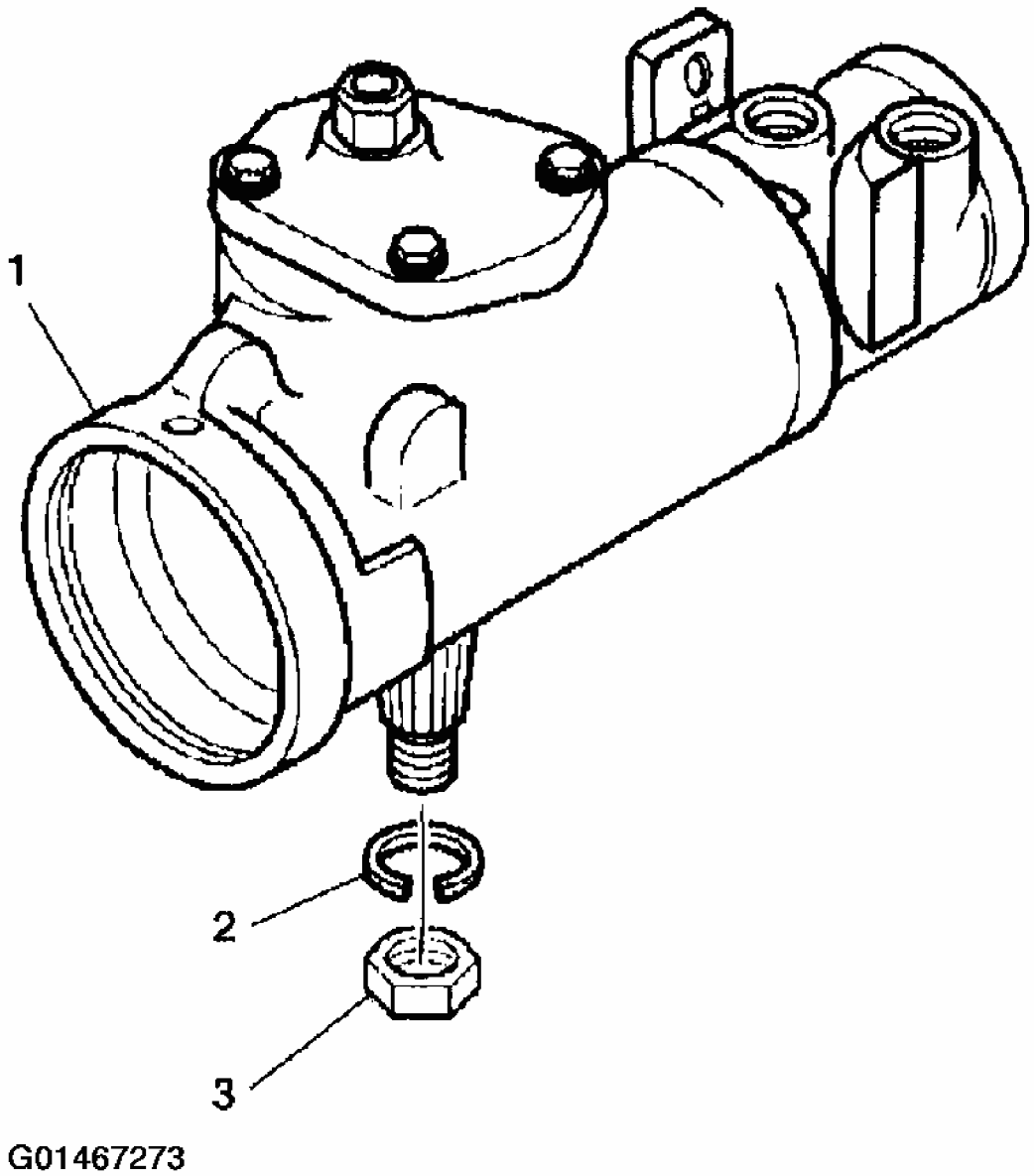

Fig. 157: Removing Nut & Lock Washer From Pitman Shaft
Courtesy of GENERAL MOTORS CORP.

6. Loosen the adjuster lock nut (1).
7. Remove the bolts (2).
8. Remove the nut.
9. Rotate the stub shaft (6) using a 12-point socket to center the steering gear (7).

Important: When removing the pitman shaft assembly, the pitman arm and its components may fall from the steering gear housing. Support the pitman arm and its

components while removing the pitman shaft assembly.

10. Remove the following items as an assembly:
    - The side cover (8)
    - The gasket (3)
    - The pitman shaft (4)
11. Remove the pitman shaft (4) from the side cover (8).

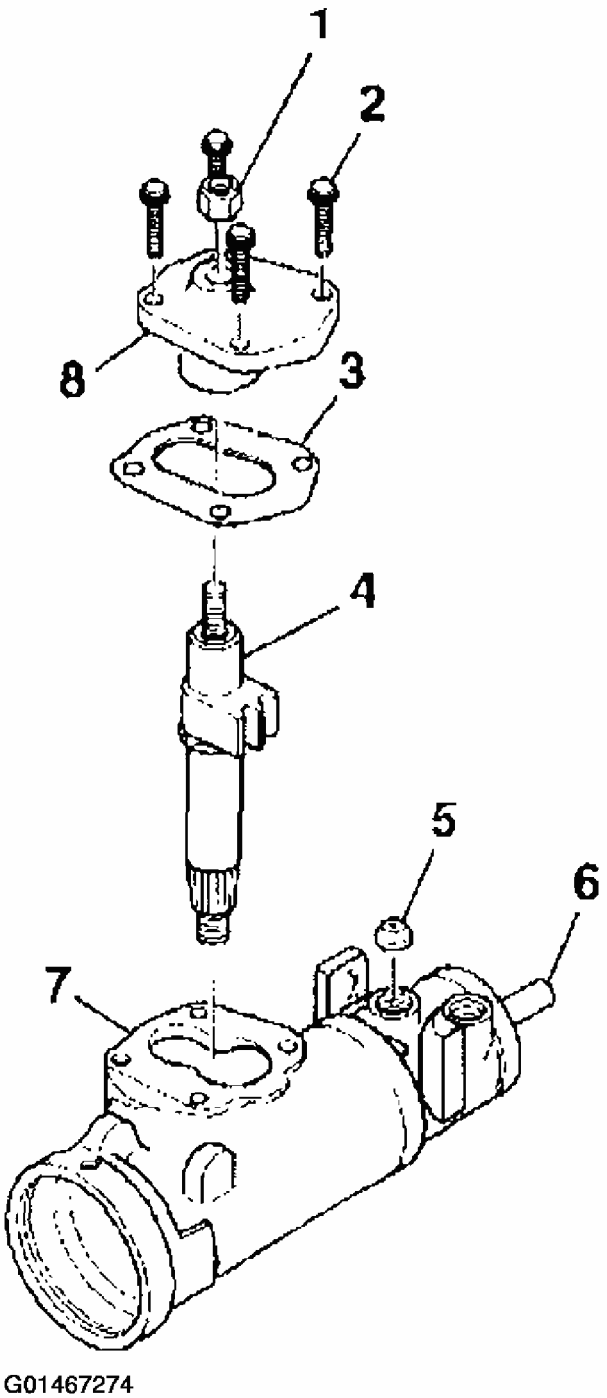

Fig. 158: Removing Pitman Shaft & Gasket From Side Cover
Courtesy of GENERAL MOTORS CORP.

Assembly Procedure

1. Screw the pitman shaft (4) to the side cover (8) until it fully seats to the side cover (8).
2. Install the adjuster lock nut (1). Do not tighten the adjuster lock nut (1) until the pitman

shaft adjustment is completed.

3. Install the pitman shaft assembly (4) and the side cover (8) to the steering gear housing (7).

NOTE: Refer to FASTENER NOTICE in Cautions and Notices.

4. Install the bolts (2).

Tighten

Tighten the bolts (2) to 60 N.m (45 lb ft).

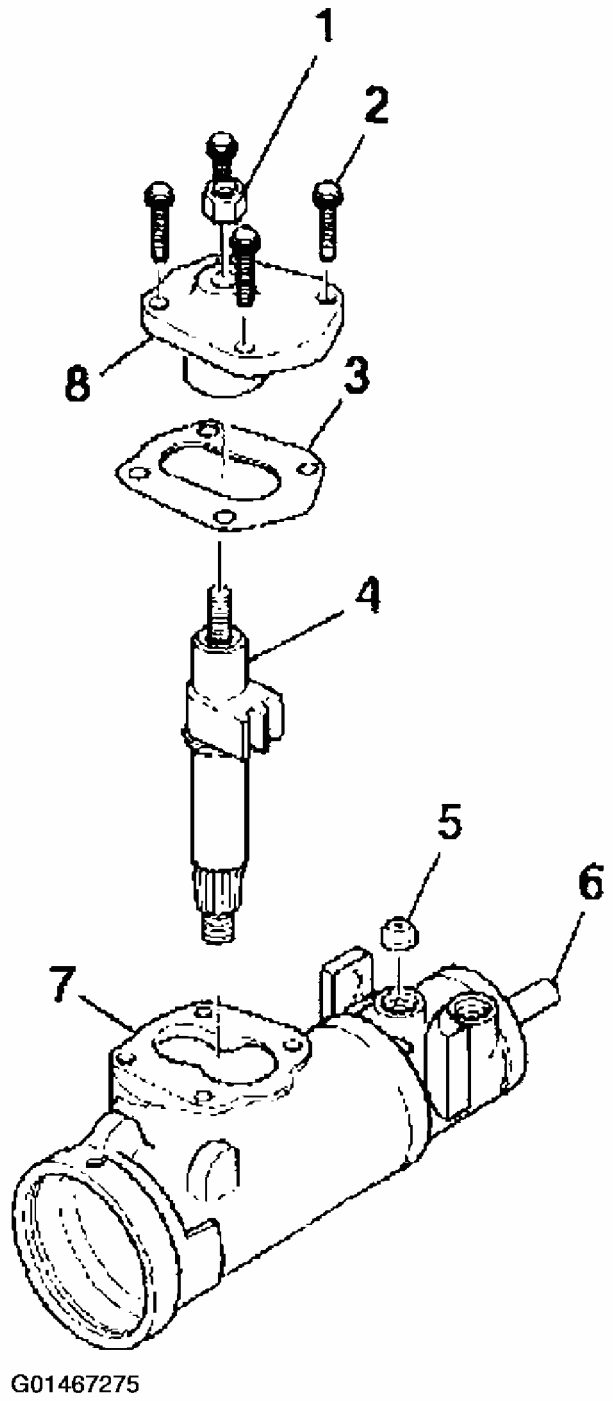

Fig. 159: Installing Pitman Shaft Assembly & Side Cover To Steering Gear Housing
Courtesy of GENERAL MOTORS CORP.

5. Install the lock washer (2).
6. Install the nut (3).

7. Refer to **PITMAN SHAFT OVER-CENTER PRELOAD ADJUSTMENT - OFF VEHICLE (700 GEAR)** to adjust the pitman shaft.

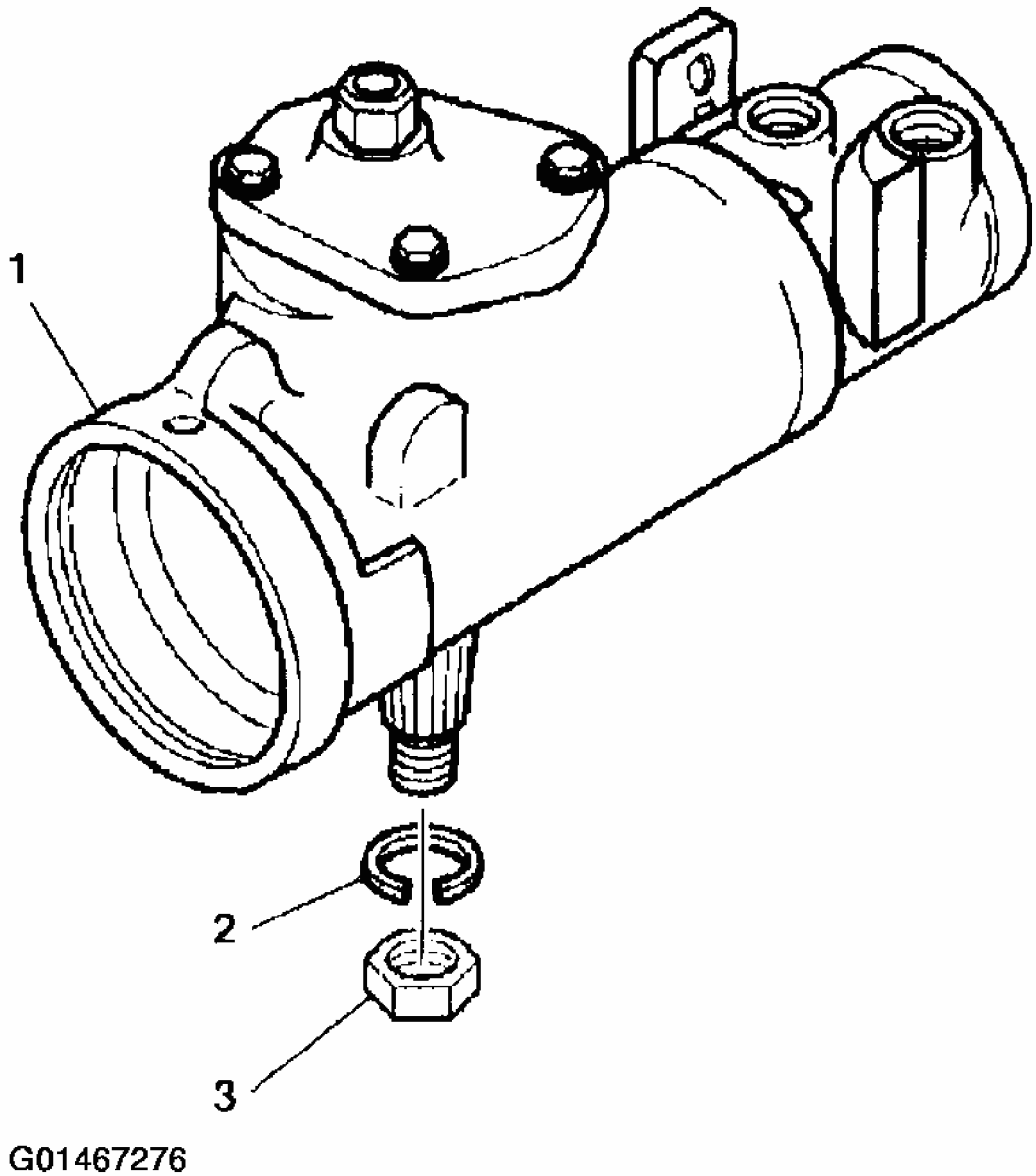

Fig. 160: Installing Nut & Lock Washer To Pitman Shaft
Courtesy of GENERAL MOTORS CORP.

STEERING GEAR HOUSING END PLUG REPLACEMENT - OFF VEHICLE

Disassembly Procedure

1. Rotate the stub shaft back and forth to drain the fluid.

2. Insert a punch into the housing access hole to unseat the retaining ring (1).
3. Remove the plug (2).
4. Remove the O-ring seal (3).

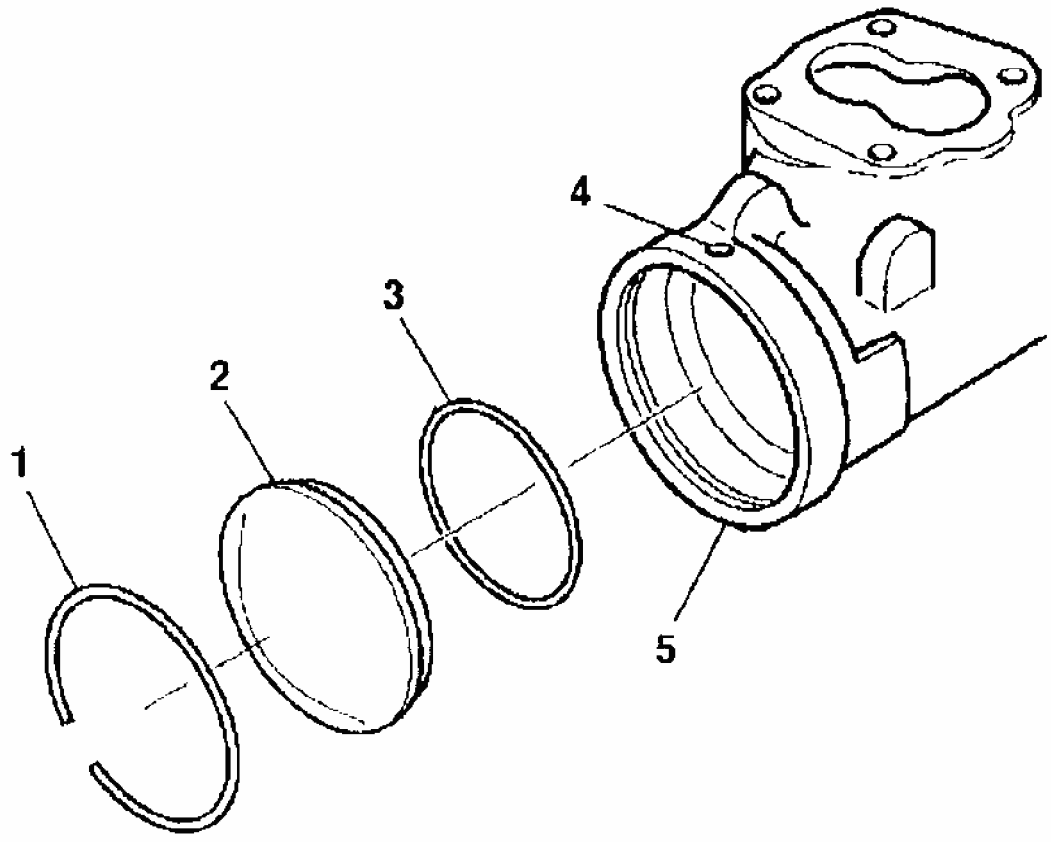

Fig. 161: Removing O-Ring Seals From Steering Gear Housing
Courtesy of GENERAL MOTORS CORP.

Assembly Procedure

1. Lubricate the O-ring seal (3) with power steering fluid.
2. Install the O-ring seal (3) into the steering gear housing (5).
3. Install the plug (2).
4. Install the retaining ring (1). Ensure that the retaining ring open end is approximately 25 mm (1 in) from the access hole in the steering gear housing (5).

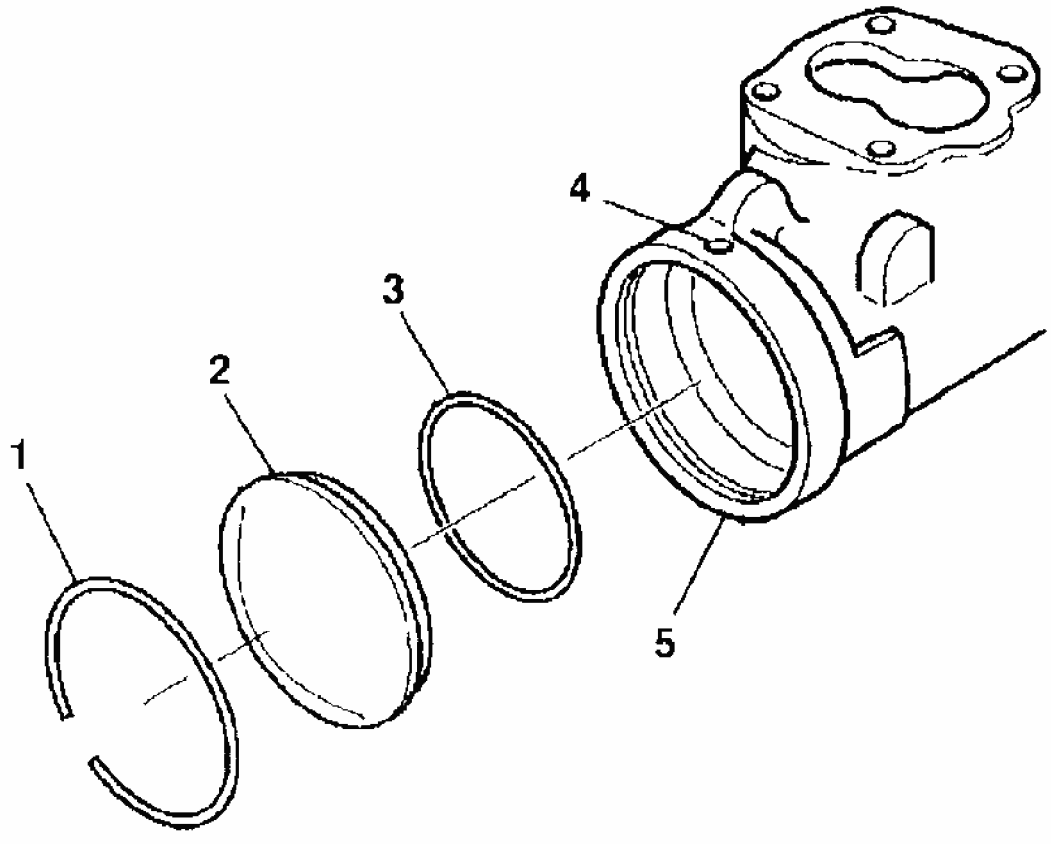

Fig. 162: Installing O-Ring Seal Into Steering Gear Housing
Courtesy of GENERAL MOTORS CORP.

STEERING GEAR VALVE REPLACEMENT - OFF VEHICLE (700 GEAR)

Disassembly Procedure

1. Remove the thrust support assembly. Refer to **STEERING GEAR THRUST SUPPORT REPLACEMENT - OFF VEHICLE (700 GEAR)** .
2. Remove the stub shaft (1) and the valve assembly (2) from the steering gear housing.
3. If necessary, remove the stub shaft (1) from the valve assembly (2) in the following manner:
    3.1. Tap the stub shaft (1) lightly on a wood block in order to loosen the cap.
    3.2. Pull the cap and the valve spool out from valve body (2) 6 mm (1/4 in).
    3.3. Disengage the stub shaft pin (3) from the hole in the valve spool (4).

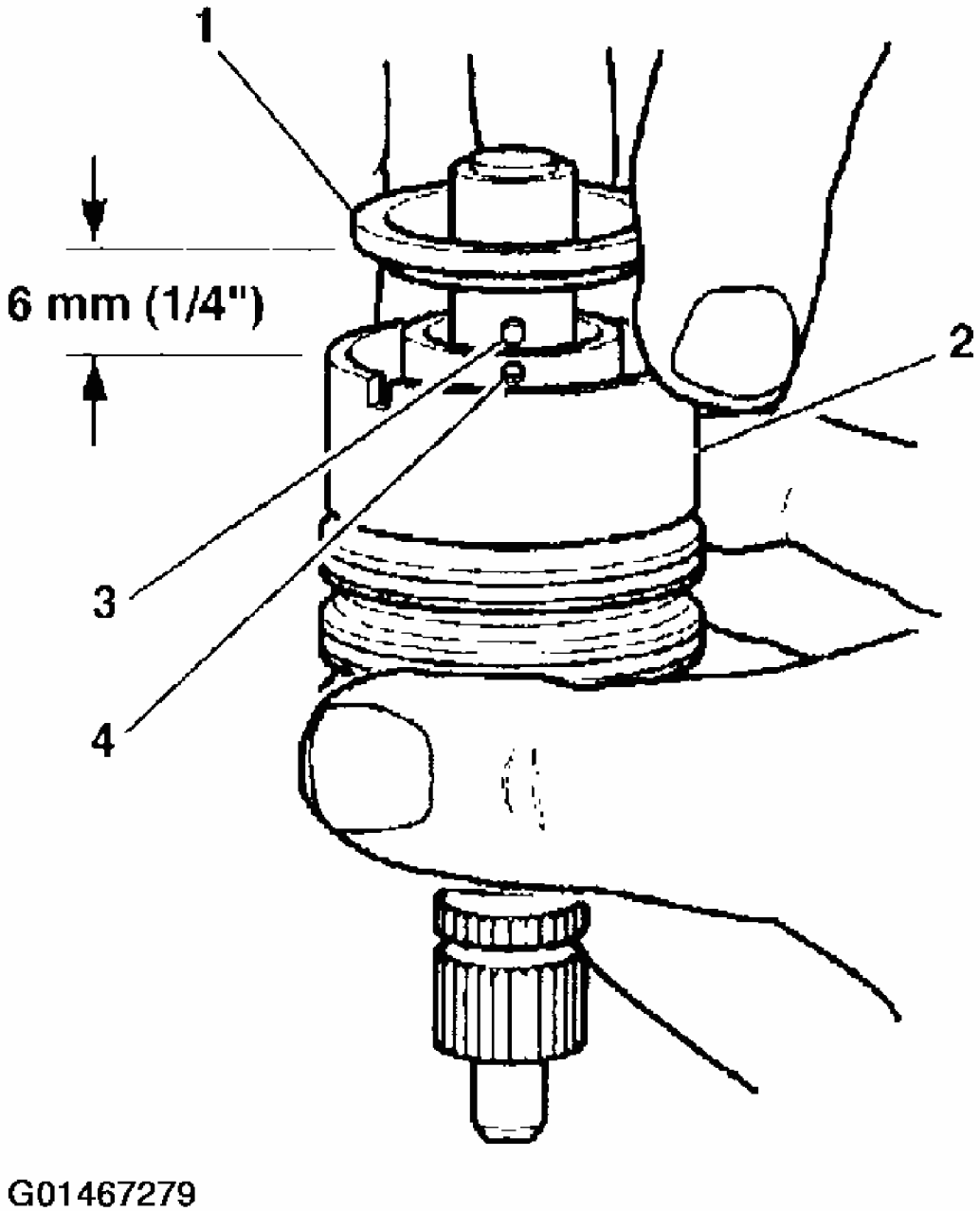

Fig. 163: Removing Stub Shaft & Valve Assembly From Steering Gear Housing
Courtesy of GENERAL MOTORS CORP.

4. If the valve assembly needs repair, disassemble the valve in the following manner:
    4.1. Simultaneously pull and rotate the valve spool (1) from the valve body (3).
    4.2. Remove the valve spool O-ring seal (2).
    4.3. Alternately remove the valve body teflon rings (5) and the O-ring seals (4).

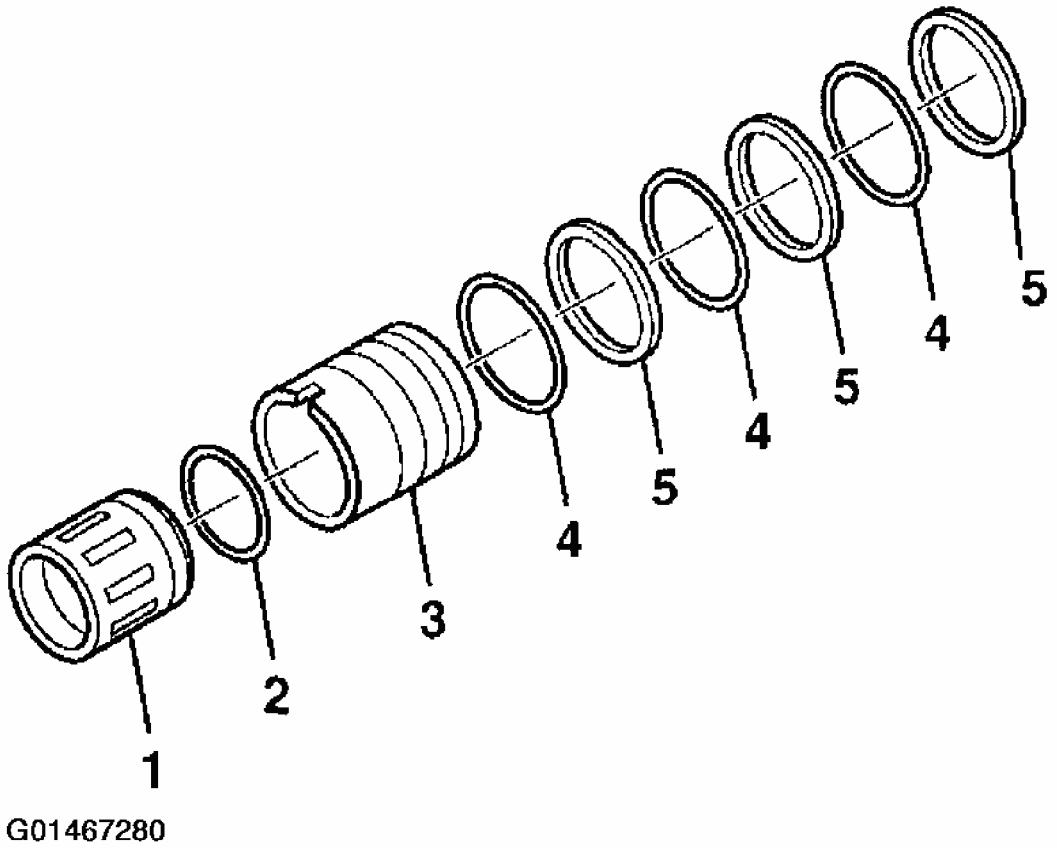

Fig. 164: Valve Body Teflon Rings & O-Ring Seals
Courtesy of GENERAL MOTORS CORP.

Assembly Procedure

1. If disassembled, reassemble the valve assembly in the following manner:
    1.1. Alternately install the valve body teflon rings (5) and the O-ring seals (4).
    1.2. Install the valve spool O-ring seal (2) to the valve spool (1).
    1.3. Lubricate the valve spool (1) and O-ring seal (2) with power steering fluid.

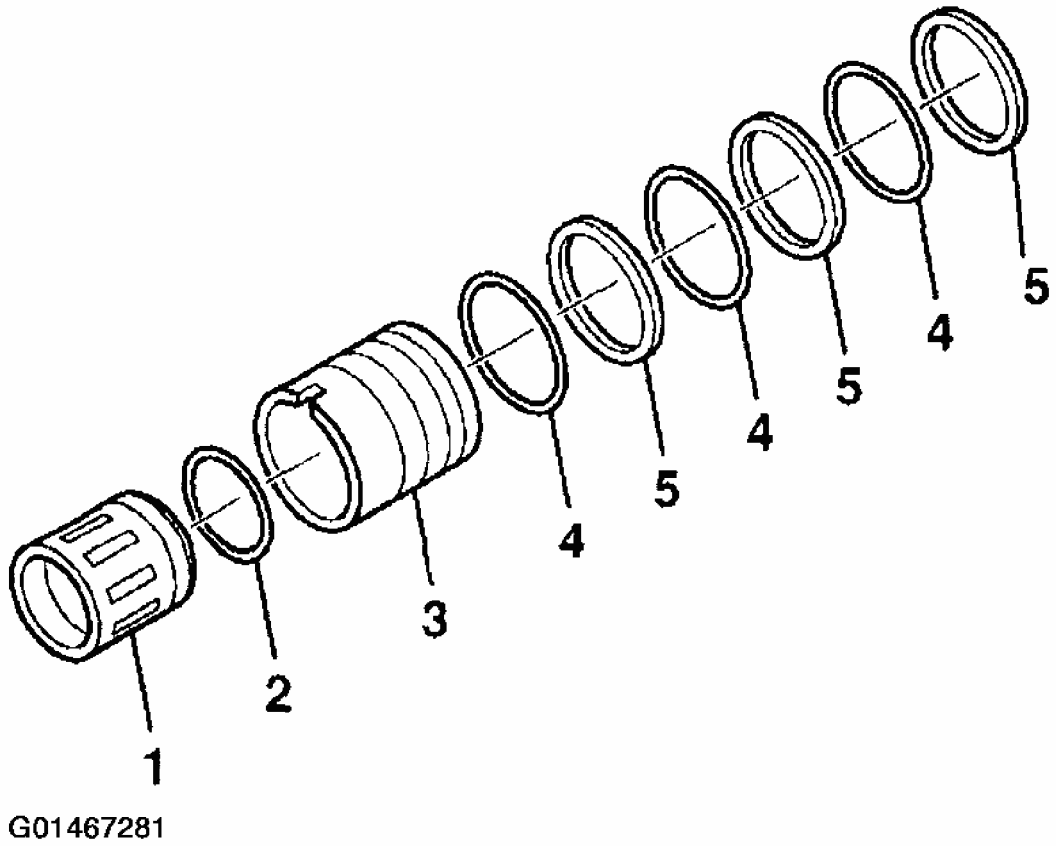

Fig. 165: Valve Body Teflon Rings & O-Ring Seals
Courtesy of GENERAL MOTORS CORP.

2. Simultaneously push and rotate the valve spool (2) into the valve body (1) until the hole (3) in the valve spool (2) for the stub shaft pin is accessible from the opposite end of the valve body (1).

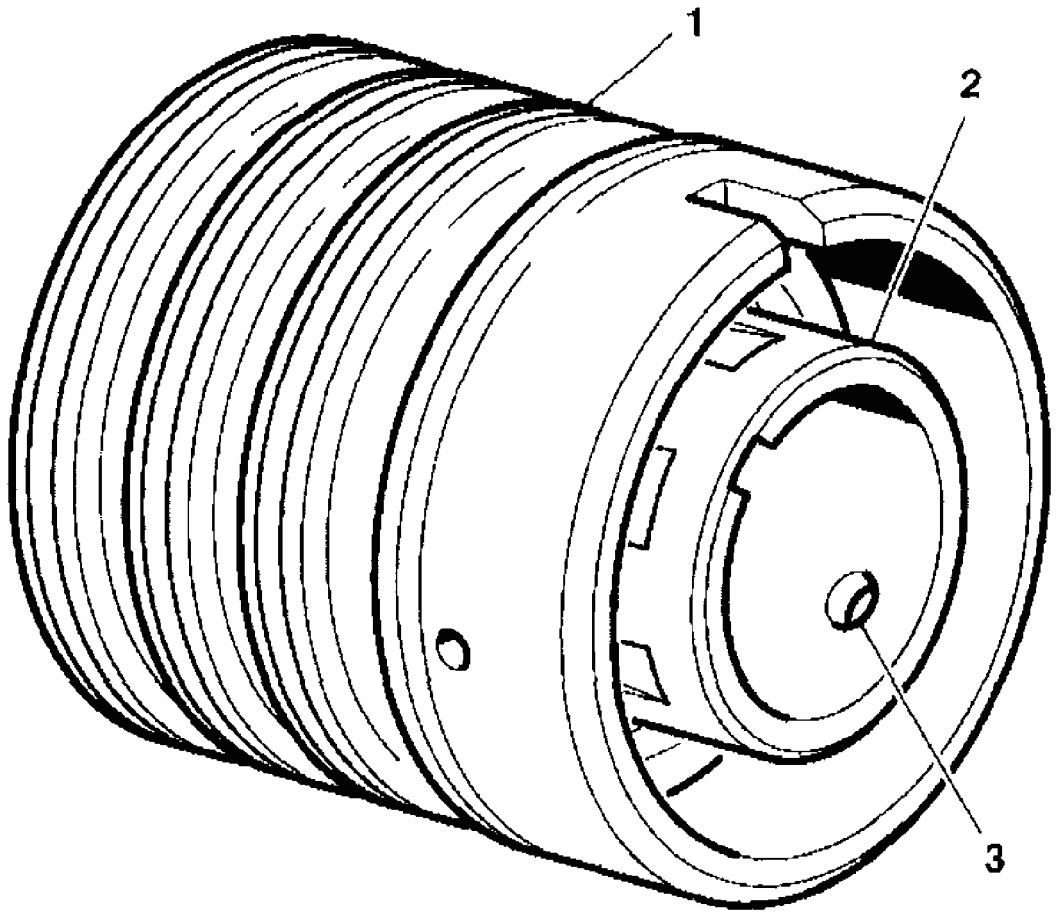

Fig. 166: Pushing & Rotating Valve Spool Into Valve Body
Courtesy of GENERAL MOTORS CORP.

3. If necessary, install the stub shaft to the valve spool in the following manner:

   Lubricate the stub shaft assembly (3).

   3.1. Insert the stub shaft (3) into the valve spool.
   3.2. Insert the pin.

   Important: Make sure that the shaft cap notch (1) is mated with the valve body pin before installing the valve body into the steering gear assembly.

   3.3. The notch in the cap (1) must fully engage the valve body pin (2). Seat the cap against the valve body shoulder.

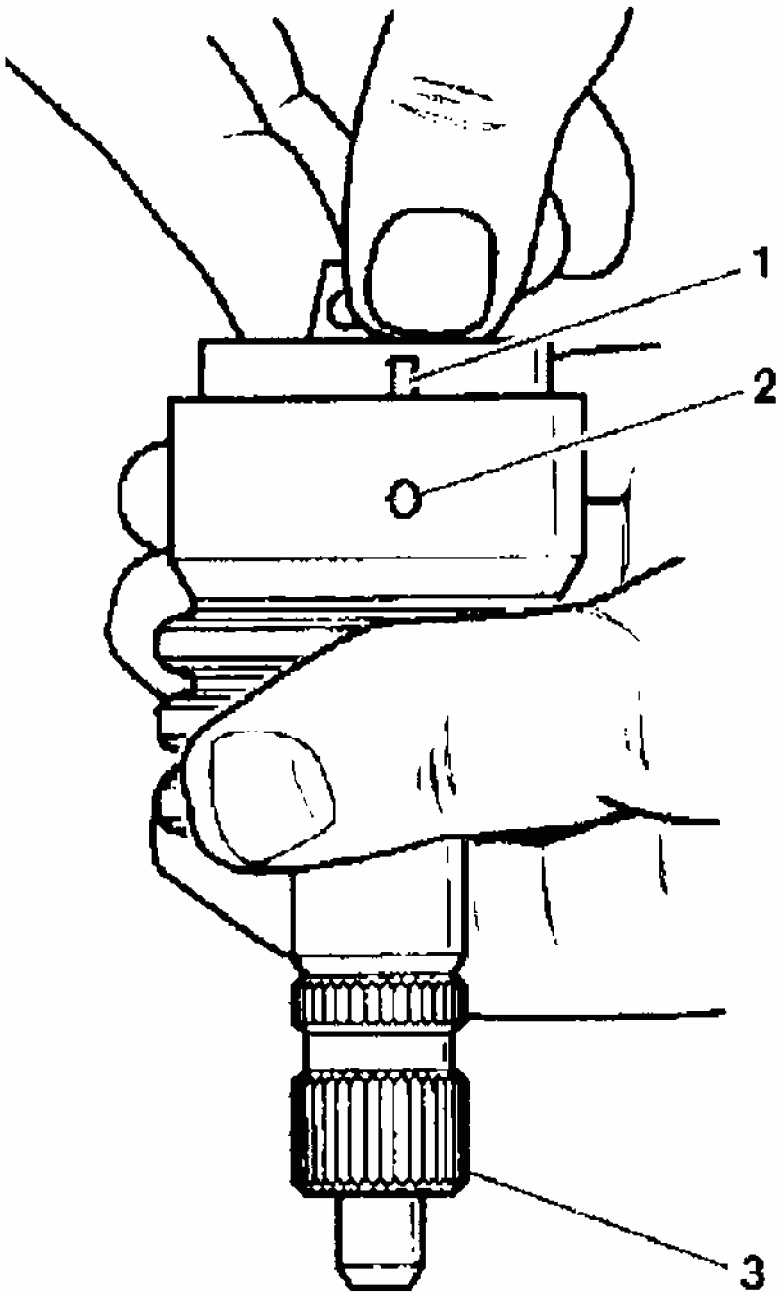

Fig. 167: Installing Stub Shaft To Valve Spool
Courtesy of GENERAL MOTORS CORP.

4. Install the stub shaft (7) and valve assembly (6) to the worm shaft (5). Ensure the pin fits in the worm shaft to the slot in the valve assembly.
5. Install the thrust support assembly. Refer to **STEERING GEAR THRUST SUPPORT REPLACEMENT - OFF VEHICLE (700 GEAR)** .

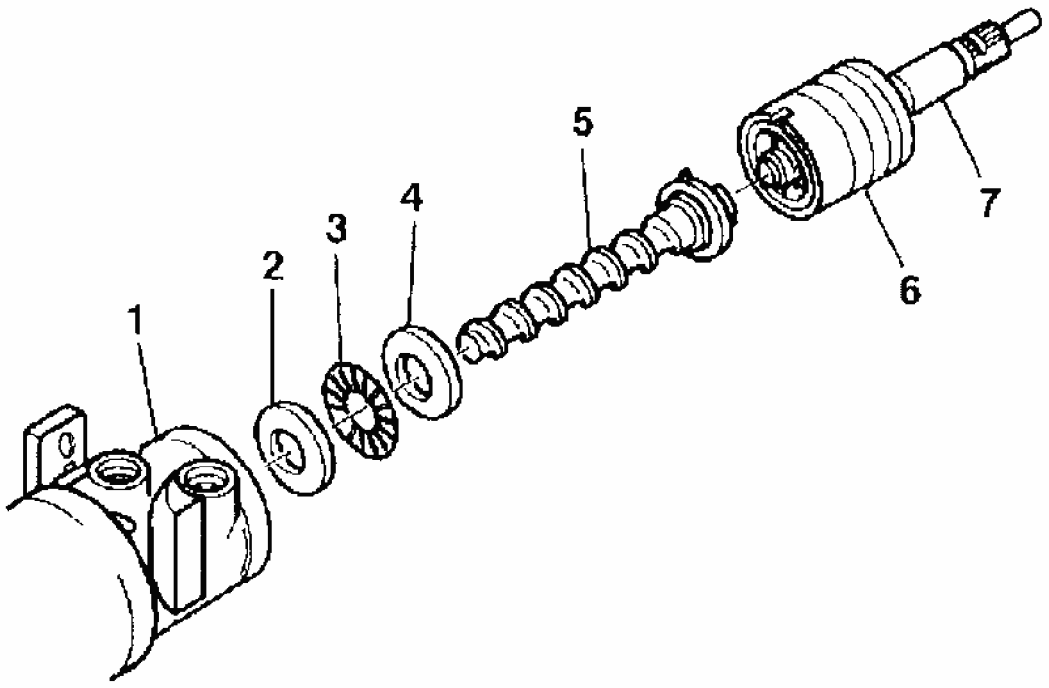

Fig. 168: Installing Stub Shaft & Valve Assembly To Worm Shaft
Courtesy of GENERAL MOTORS CORP.

RACK PISTON AND WORM SHAFT REPLACEMENT - OFF VEHICLE (700 GEAR)

Tools Required

- *J 21552* Rack Piston Arbor
- *J 8947* Rack Piston Teflon Ring Compressor

Disassembly Procedure

Important: Do not remove the needle bearing when removing the pitman shaft arm and its components.

1. Remove the pitman shaft seals and bearing. Refer to **PITMAN SHAFT SEALS AND BEARING REPLACEMENT - OFF VEHICLE (700 GEAR)** .
2. Remove the housing end plug. Refer to **STEERING GEAR HOUSING END PLUG REPLACEMENT - OFF VEHICLE** .

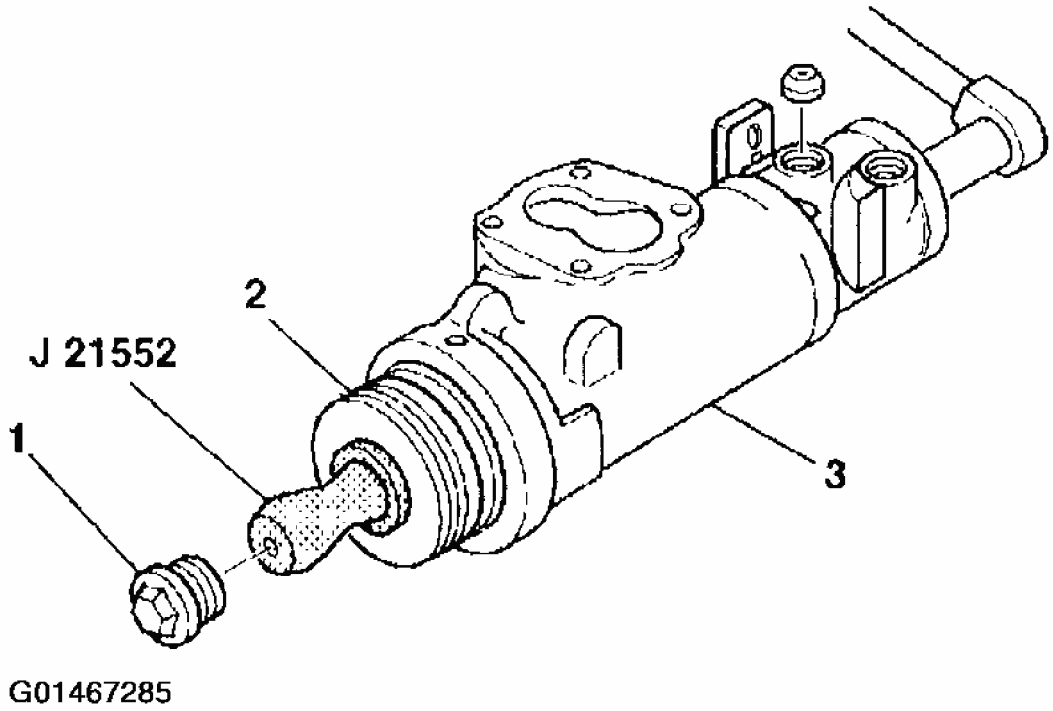

Fig. 169: Removing Rack Piston From Steering Gear Housing
Courtesy of GENERAL MOTORS CORP.

3. Turn the stub shaft counterclockwise until the rack piston (2) begins to come out of the steering gear housing (3).
4. Remove the rack piston plug (1).
5. Insert *J 21552* into the bore of the rack piston (2).
6. Hold *J 21552* tightly against the worm shaft while turning the stub shaft counterclockwise. Turning the stub shaft forces the rack piston (2) onto *J 21552* . The rack piston balls remain in place.
7. Remove the following items as an assembly from the steering gear housing (9):
   - The rack piston (4)
   - The rack piston screws (8), clamp (7), ball guide (6) and balls (5)
   - *J 21552*
8. Remove the spool valve assembly. Refer to **STEERING GEAR VALVE REPLACEMENT - OFF VEHICLE (700 GEAR)** .
9. Remove the worm shaft (14).
10. Remove the thrust bearing (12) and the flat races (11, 13).

Important: When removing *J 21552* , watch for falling piston balls (5) from inside the

rack piston (4).

11. Remove *J 21552* from the rack piston (4).

    Remove the rack piston balls (5).

12. Remove the following items from the rack piston (4):
    1. 12.1. The screws (8)
    2. 12.2. The clamp (7)
    3. 12.3. The ball guide (6)
    4. 12.4. The remaining rack piston balls (5) in the ball guide (6)
13. Remove the teflon ring (2).
14. Remove the O-ring seal (3).
15. Clean all of the disassembled parts.
16. Inspect all of the disassembled parts for wear.
17. Replace the parts if necessary.

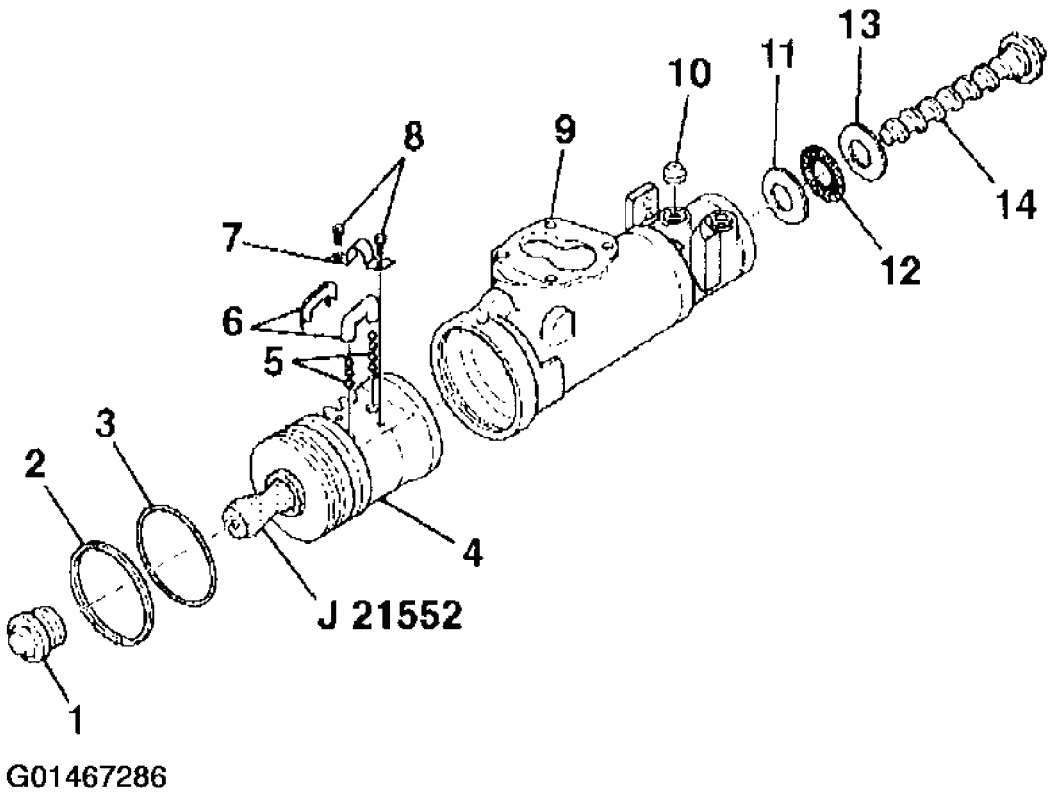

Fig. 170: Removing Screws, Clamp Or Ball Guide From Rack Piston & Warm Shaft, Thrust Bearing Or Flat Races

Courtesy of GENERAL MOTORS CORP.

Assembly Procedure

1. Install the O-ring seal (3) and the teflon ring (2).
2. Lubricate both parts with power steering fluid.
3. Install the worm shaft (14) to the rack piston (4) outside of the steering gear housing (9).

   Fully seat the worm shaft to the rack piston.

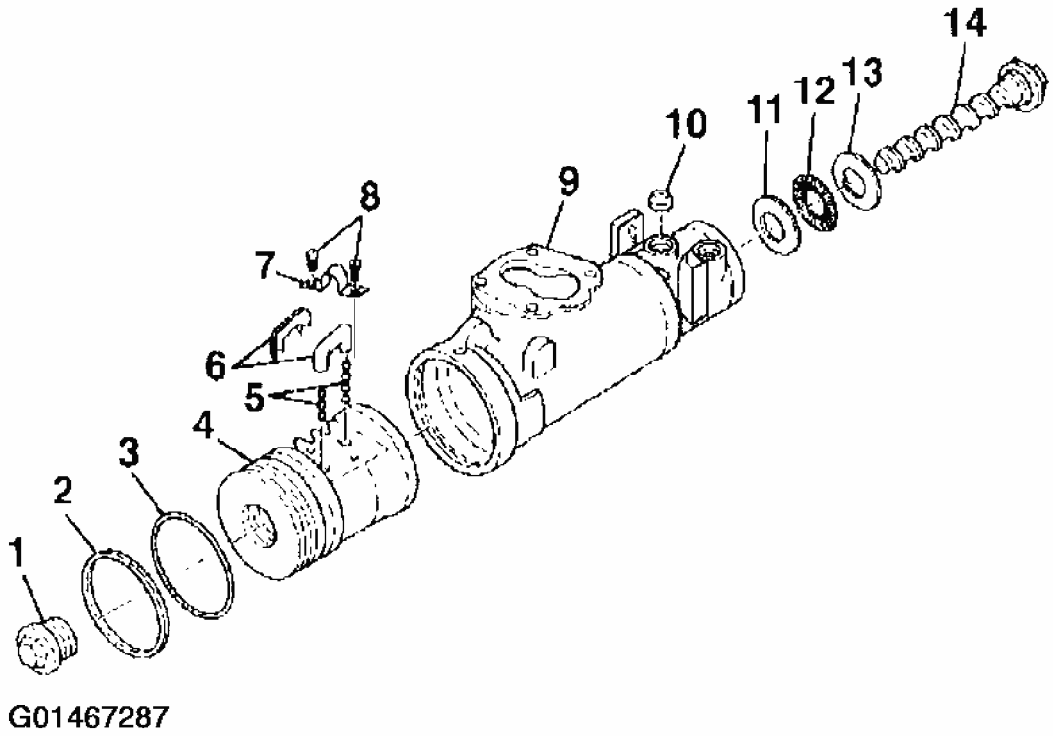

Fig. 171: Installing Worm Shaft To Rack Piston Outside Of Steering Gear Housing
Courtesy of GENERAL MOTORS CORP.

4. Align the worm shaft spiral groove with the rack piston ball return guide hole (1).

   Important: Improper rack piston ball installation may result in personal injury. The black rack piston balls are smaller than the silver rack piston balls. Install the black and the silver rack piston balls alternately into the rack piston and the ball guide to maintain the rack piston to the worm shaft preload.

5. Lubricate the rack piston balls with power steering fluid.
6. Insert the rack piston balls through the ball return guide hole (1) while turning worm shaft (2) counterclockwise in order to install the rack piston balls into the rack piston.

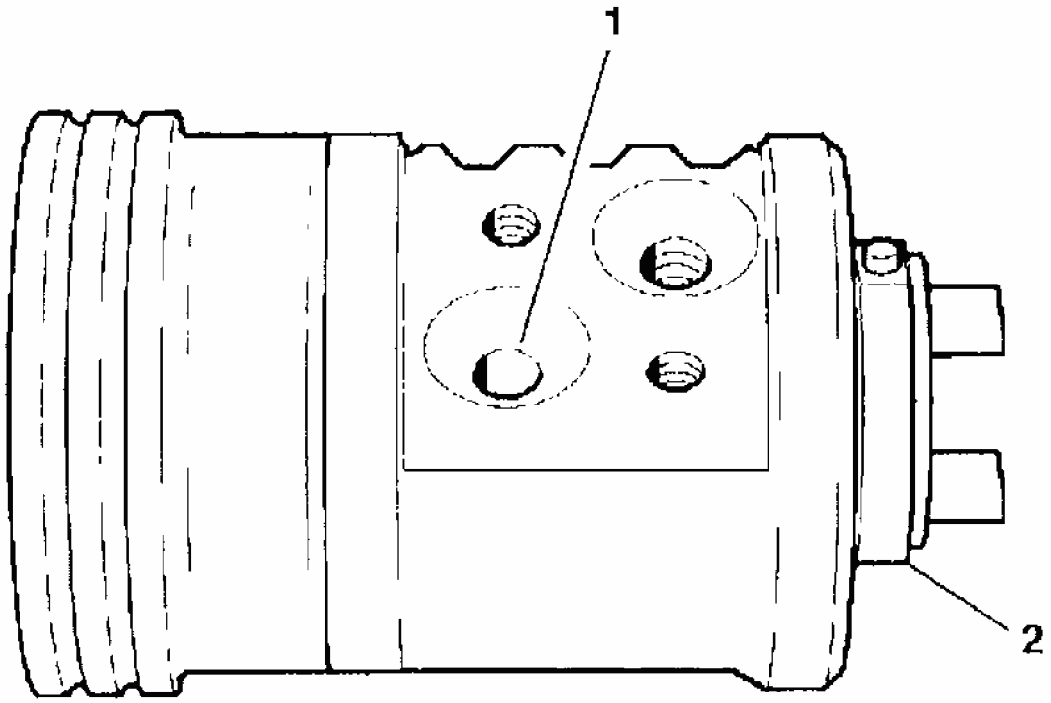

Fig. 172: Identifying Ball Return Guide Hole & Worm Shaft
Courtesy of GENERAL MOTORS CORP.

7. Install the remaining rack piston balls (3) into the ball guide (1) using grease at each end (2) to retain the rack piston balls (3).

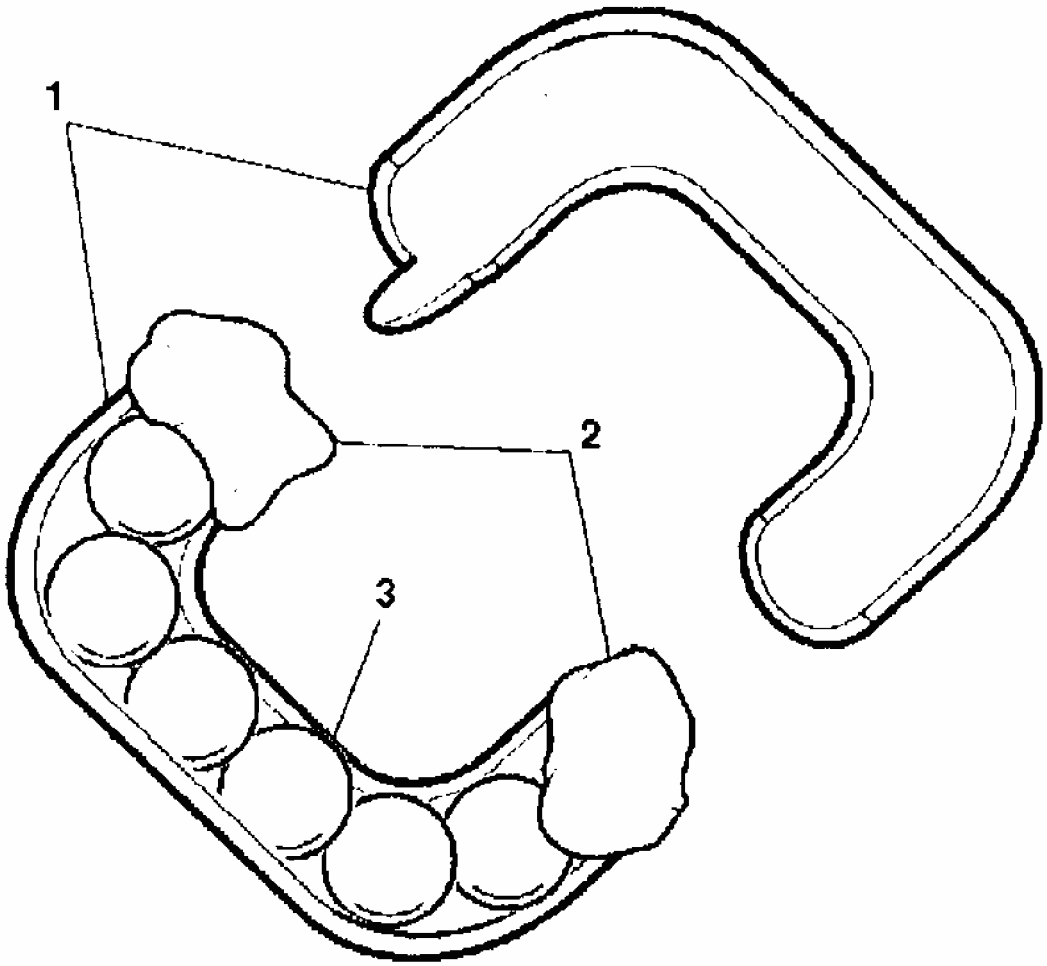

Fig. 173: Installing Remaining Rack Piston Balls Into Ball Guide
Courtesy of GENERAL MOTORS CORP.

8. Install the ball guide (3) to the rack piston (2).
9. Install the ball guide clamp (4).

NOTE: Refer to FASTENER NOTICE in Cautions and Notices.

10. Install the screws (5).

Tighten

Tighten the screws (5) to 6 N.m (53 lb in).

11. Insert *J 21552* into the bore of the rack piston while turning the worm shaft

counterclockwise. The turning of the worm shaft forces the rack piston onto *J 21552* . The rack piston balls remain in place.

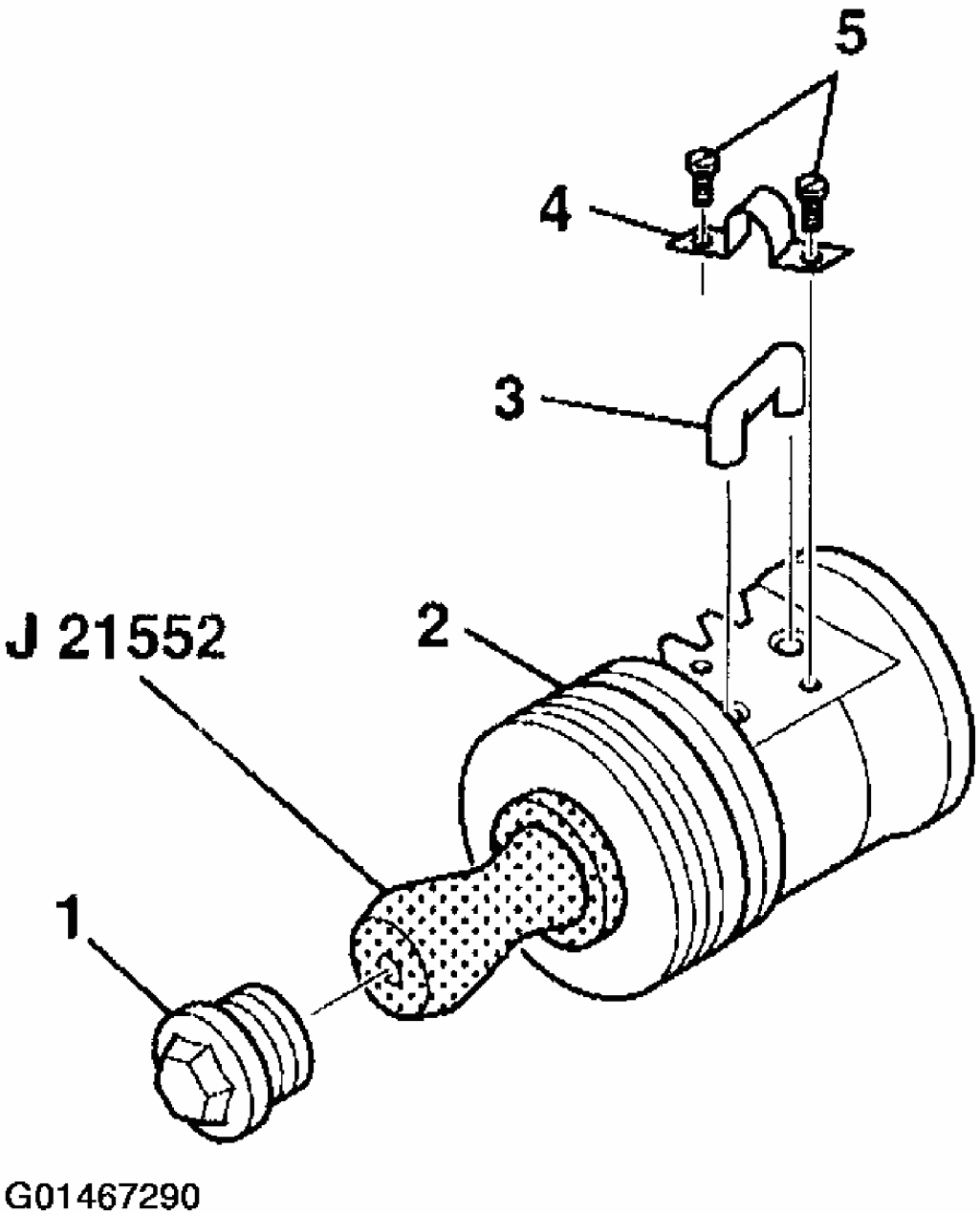

Fig. 174: Installing Ball Guide, Ball Guide Clamp & Screws To Rack Piston
Courtesy of GENERAL MOTORS CORP.

12. Install the flat races (2, 4) and the thrust bearing (3) onto the worm shaft (1).

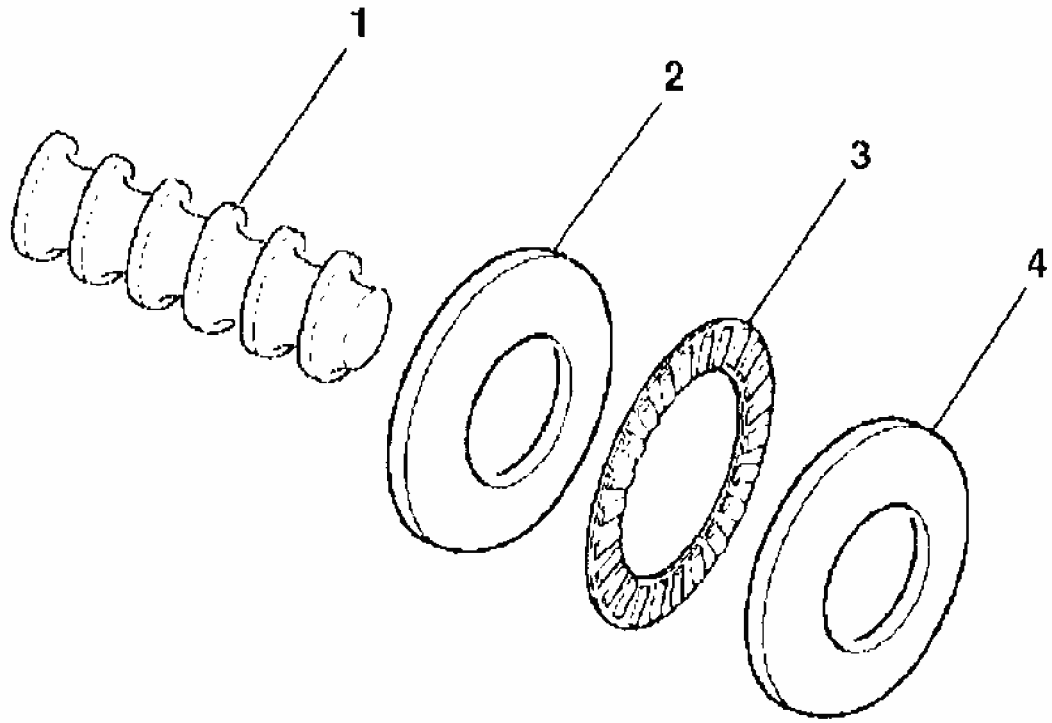

Fig. 175: Install Flat Races & Thrust Bearing Onto Worm Shaft
Courtesy of GENERAL MOTORS CORP.

13. Install the worm shaft (4) to the steering gear housing (3).

    Important: Do not adjust the worm shaft until all components are installed onto the steering gear housing.

14. Install the spool valve. Refer to **STEERING GEAR VALVE REPLACEMENT - OFF VEHICLE (700 GEAR)** .
15. Install the rack piston (2) to the worm (4) from *J 21552* using *J 8947* to compress the seals.
16. Hold *J 21552* tightly against the worm shaft (4).
17. Turn the stub shaft clockwise until the rack piston (2) is seated on the worm shaft (4).
18. Remove *J 21552* from the rack piston (1).

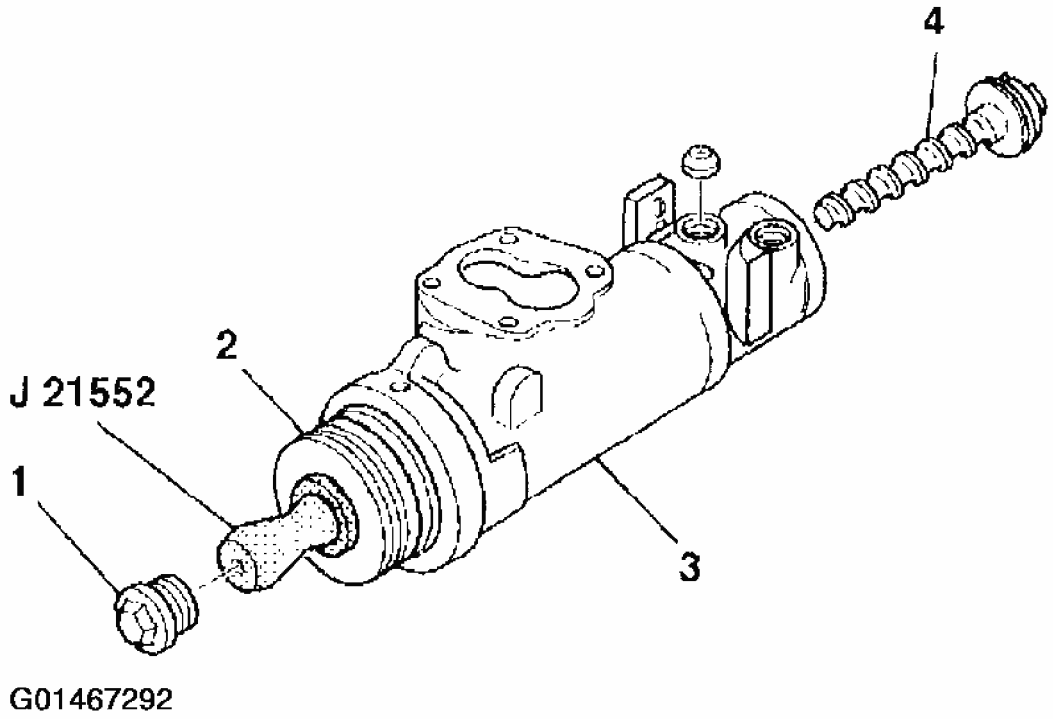

Fig. 176: Rack Piston & Warm Shaft
Courtesy of GENERAL MOTORS CORP.

19. Install the rack piston plug (1).

    Tighten

    Tighten the rack piston plug to 150 N.m (111 lb ft).

20. Install the housing end plug. Refer to **STEERING GEAR HOUSING END PLUG REPLACEMENT - OFF VEHICLE** .

    Important: Do not adjust the pitman shaft until all components are installed onto the steering gear housing.

21. Install the pitman shaft seals and bearing. Refer to **PITMAN SHAFT SEALS AND BEARING REPLACEMENT - OFF VEHICLE (700 GEAR)** .
22. To adjust the steering gear; refer to one of the following procedures:
    - **WORM THRUST BEARING PRELOAD ADJUSTMENT - OFF VEHICLE (700 GEAR)**
    - **PITMAN SHAFT OVER-CENTER PRELOAD ADJUSTMENT - OFF VEHICLE (700 GEAR)**

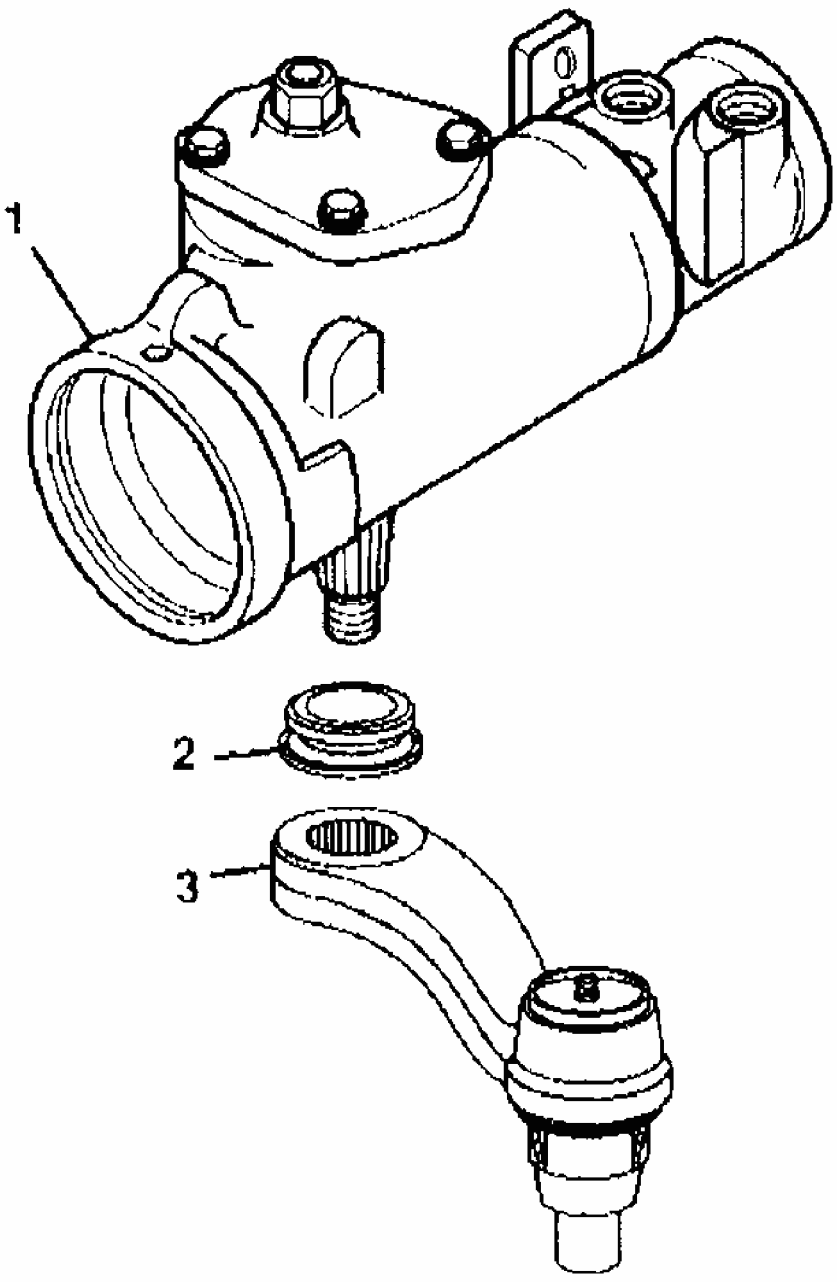

Fig. 177: Removing Pitman Arm & Pitman Shaft Boot From Steering Gear
Courtesy of GENERAL MOTORS CORP.

PITMAN SHAFT SEALS AND BEARING REPLACEMENT - OFF VEHICLE (700 GEAR)

Tools Required

- *J 6278* Pitman Shaft Bearing Remover and Installer

- *J 4245* Internal Snap Ring Pliers

Disassembly Procedure

1. Remove the pitman shaft and the side cover. Refer to **STEERING GEAR PITMAN SHAFT AND HOUSING COVER REPLACEMENT - OFF VEHICLE (700 GEAR)** .
2. Remove the pitman arm (3) from the steering gear (1).
3. Remove the pitman shaft boot (2).
4. Remove the dust seal (1).
5. Remove the retaining ring using the *J 4245* .

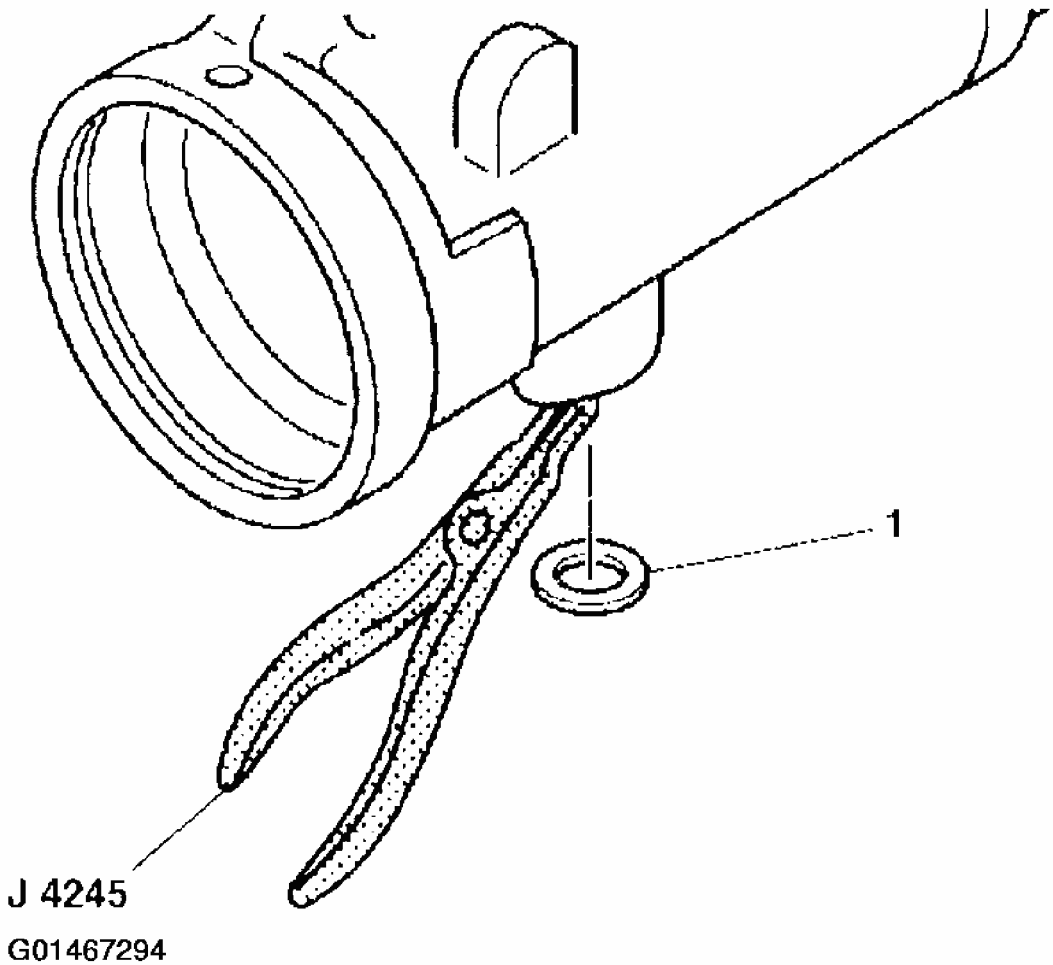

Fig. 178: Dust Seal
Courtesy of GENERAL MOTORS CORP.

Important: Use care not to score the steering gear housing bore when prying out the

seals and the washers.

6. Use a screwdriver to pry the backup washer (3) and the double lip seal (2) from the steering gear housing (1).
7. Inspect the steering gear housing (1) for burrs.

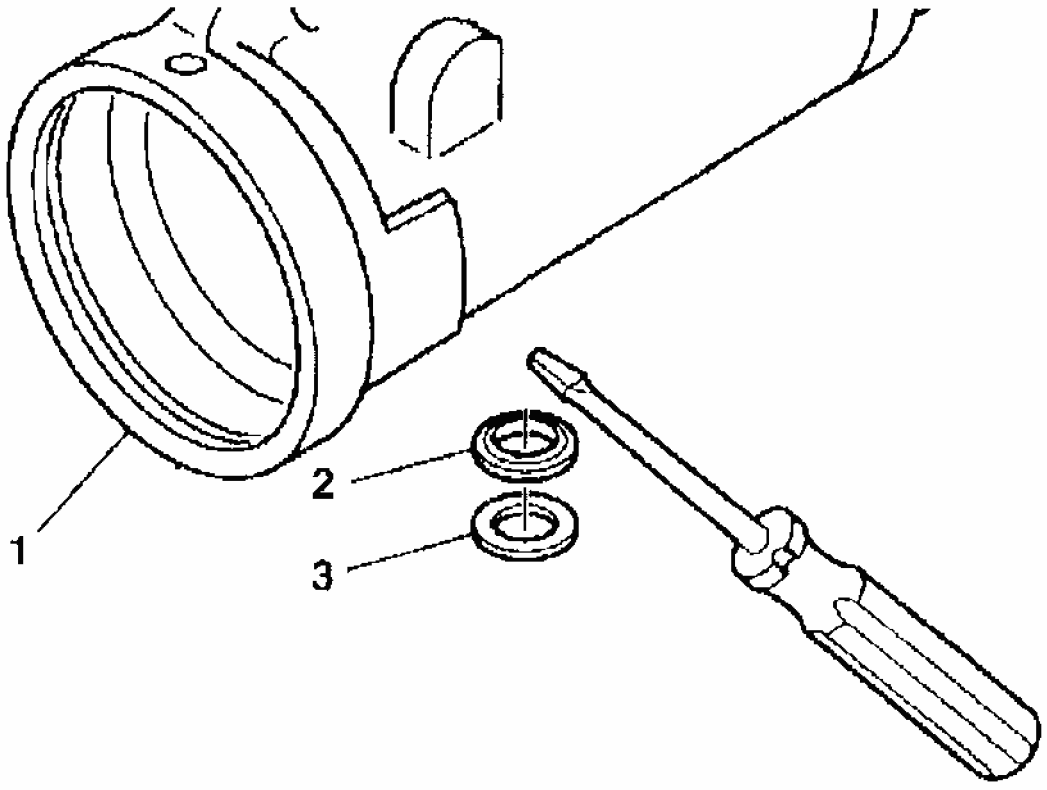

Fig. 179: Removing Backup Washer & Double Lip Seal From Steering Gear Housing
Courtesy of GENERAL MOTORS CORP.

8. Insert *J 6278* through the hole in the top of the steering gear housing (1).
9. Drive out the needle bearing (2).

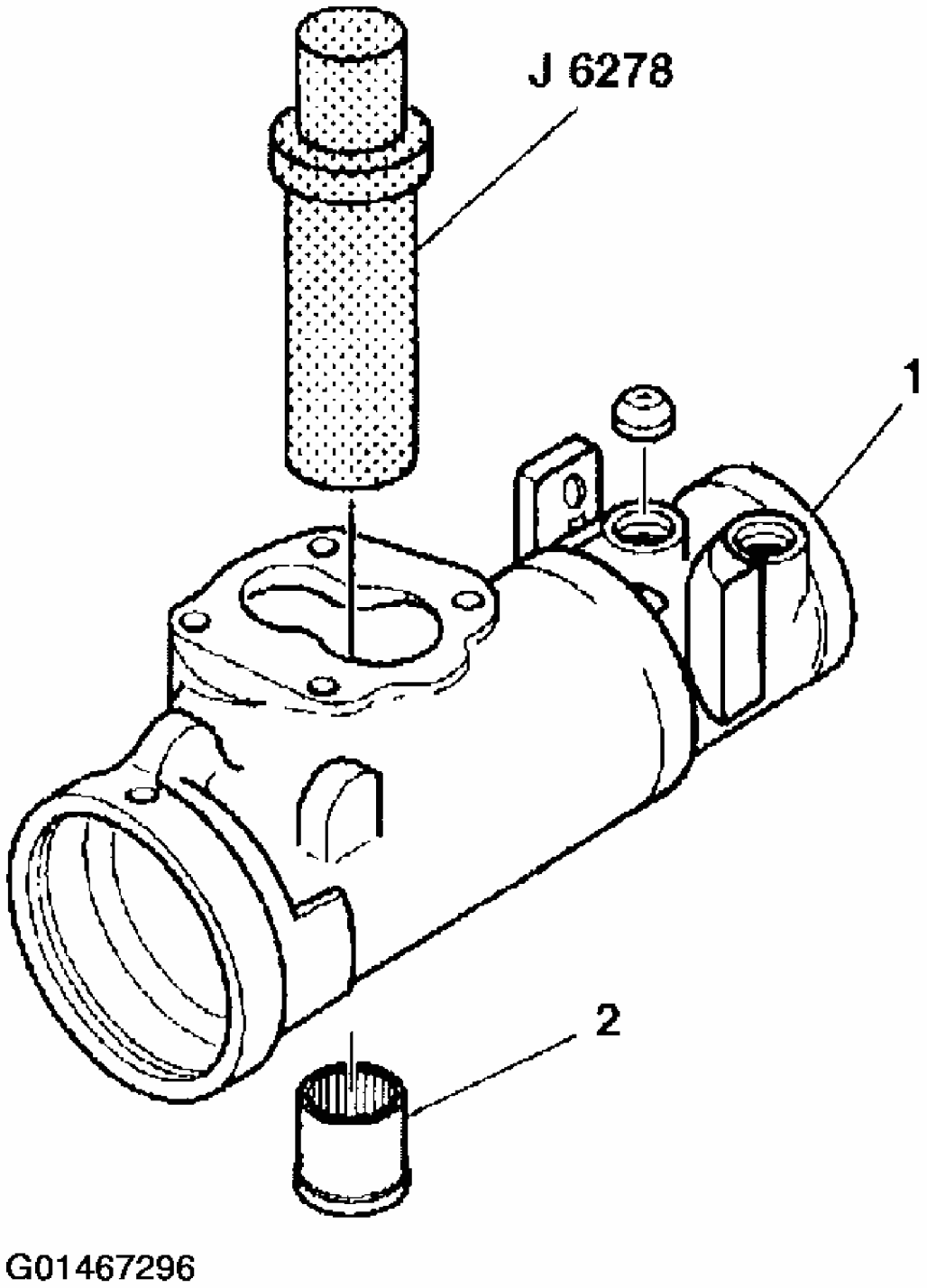

Fig. 180: Removing Needle Bearing From Steering Gear Housing
Courtesy of GENERAL MOTORS CORP.

Assembly Procedure

1. Install the needle bearing (2) to the steering gear housing (1) using the *J 6278* .

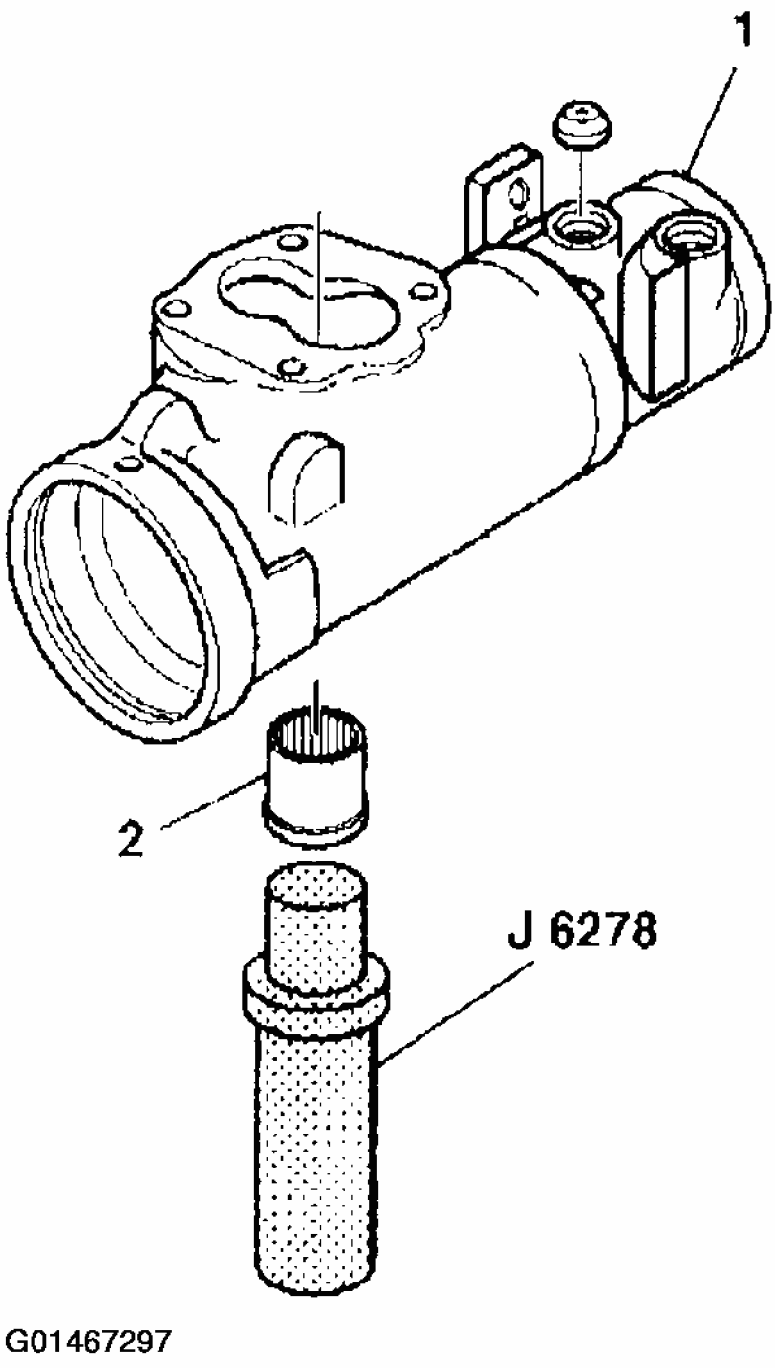

Fig. 181: Installing Needle Bearing To Steering Gear Housing
Courtesy of GENERAL MOTORS CORP.

2. Coat the double lip seal (2) and the washer (3) with grease.
3. Install the double lip seal (2).

4. Install the backup washer (3).

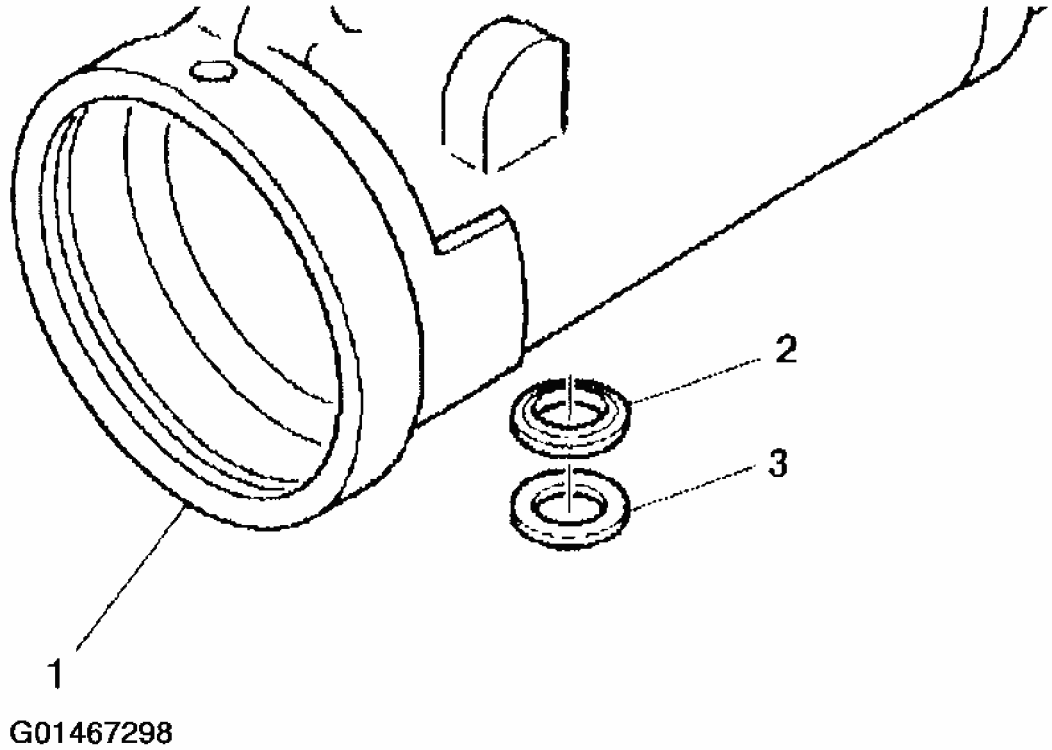

Fig. 182: Double Lip Seal & Backup Washer
Courtesy of GENERAL MOTORS CORP.

5. Install the retaining ring using the *J 4245*.

   Important: Do not install the lock washer and nut until complete installation of the pitman arm and it's components have been installed. Do not adjust the pitman shaft until all components have been installed on the steering gear housing.

6. Install the pitman shaft and the side cover. Refer to **STEERING GEAR PITMAN SHAFT AND HOUSING COVER REPLACEMENT - OFF VEHICLE (700 GEAR)** .
7. Install the dust seal (1).

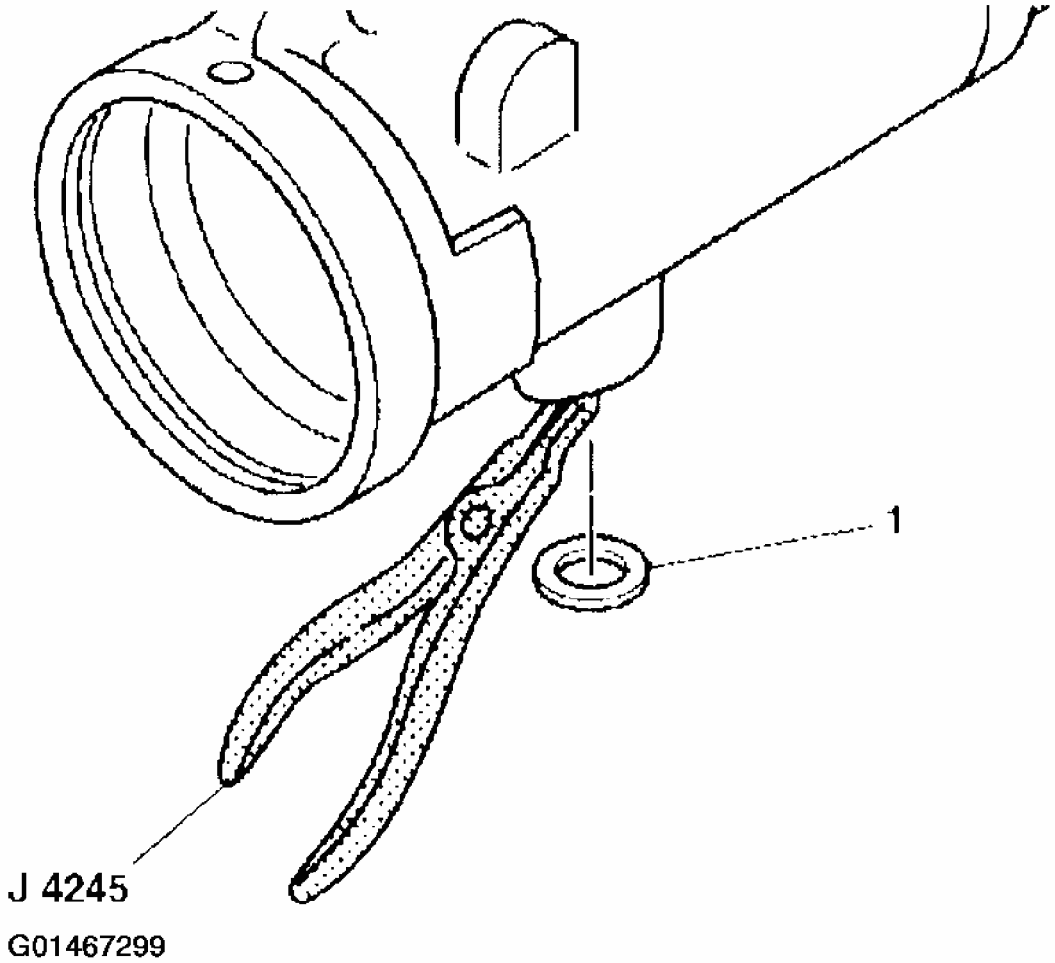

Fig. 183: Dust Seal
Courtesy of GENERAL MOTORS CORP.

8. Install the pitman shaft boot (2).
9. Install the pitman arm (3) to the steering gear (1).
10. Install the lock washer (4).

NOTE: Refer to FASTENER NOTICE in Cautions and Notices.

11. Install the nut (5).

Tighten

Tighten the pitman arm nut to 250 N.m (184 lb ft).

12. Refer to **PITMAN SHAFT OVER-CENTER PRELOAD ADJUSTMENT - OFF**

VEHICLE (700 GEAR) to adjust the pitman shaft.

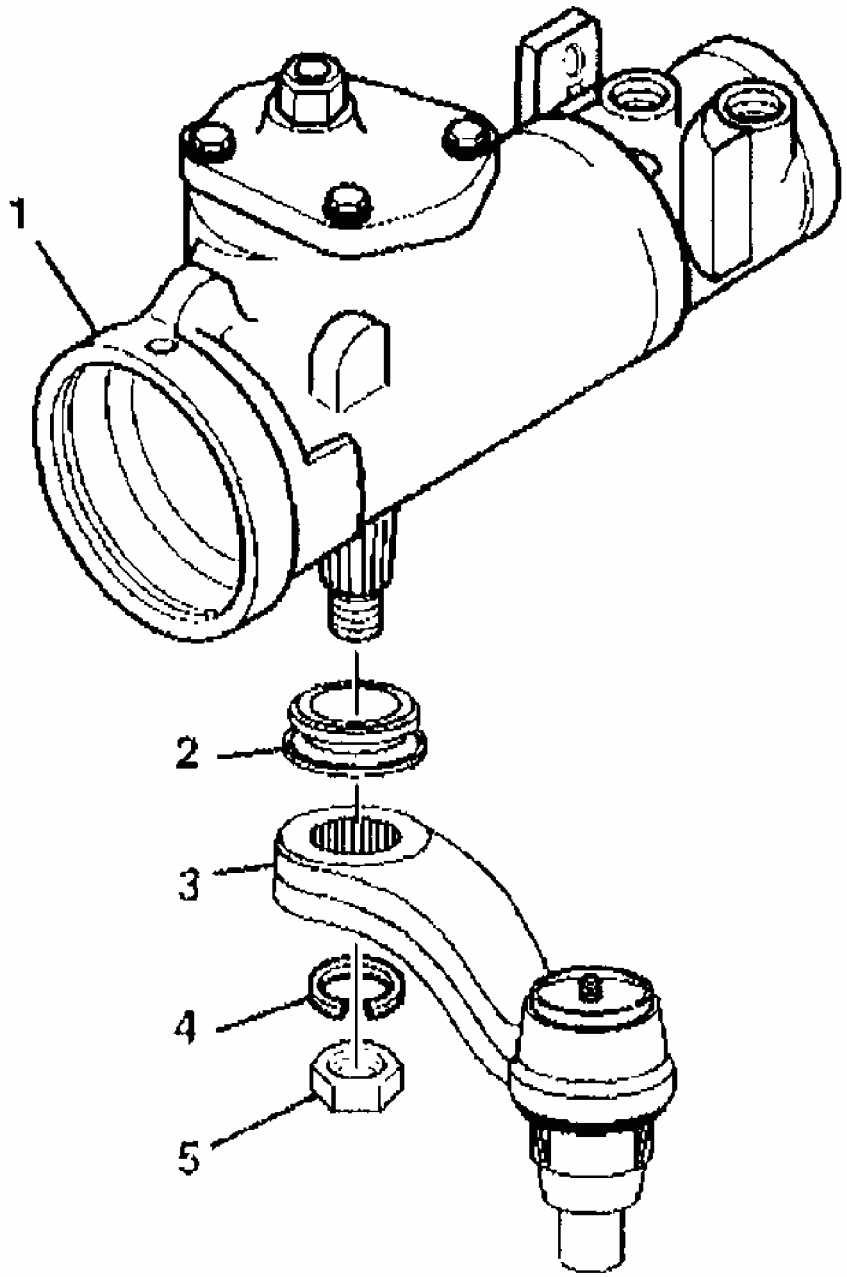

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Fig. 184: Installing Lock Washer, Pitman Shaft Boot & Pitman Arm To Steering Gear
Courtesy of GENERAL MOTORS CORP.

STEERING GEAR CHECK VALVE REPLACEMENT - OFF VEHICLE

Disassembly Procedure

Important: Do not to damage the threads of the steering gear housing when removing the check valve. Remove the check valve (1) from the steering gear housing (2) using a small screwdriver.

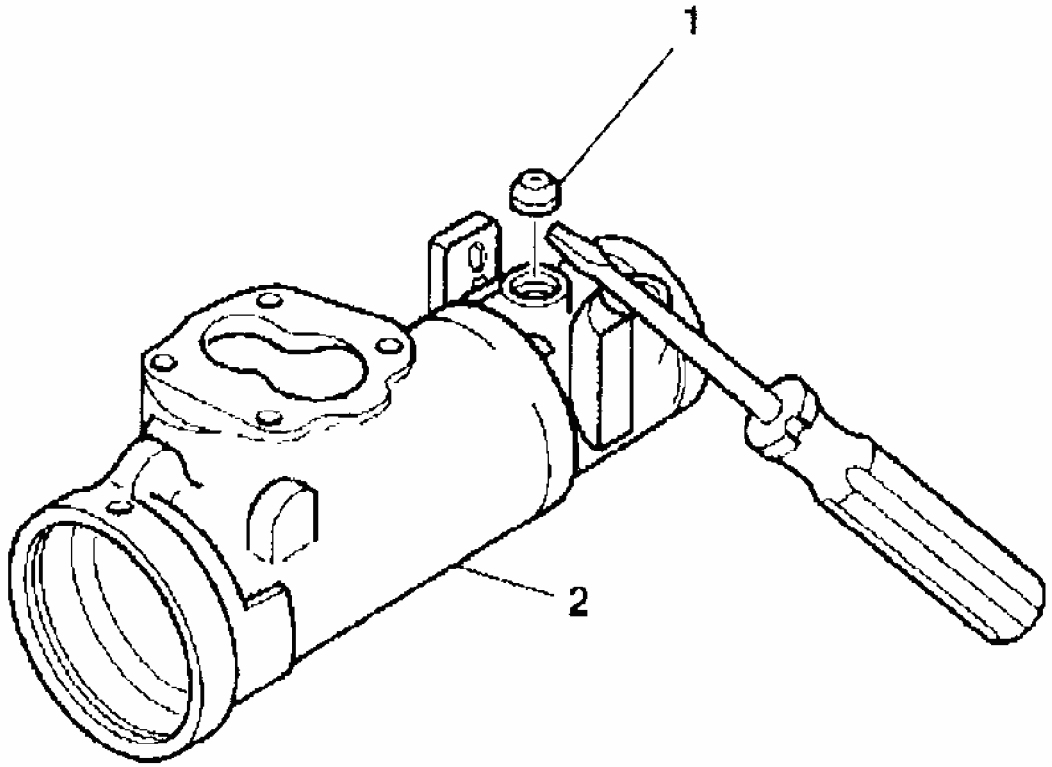

Fig. 185: Removing Check Valve From Steering Gear Housing
Courtesy of GENERAL MOTORS CORP.

Assembly Procedure

Install the check valve (1) using a 9.52 mm inch diameter piece of tubing 100 mm (4 in) long to drive into the steering gear housing.

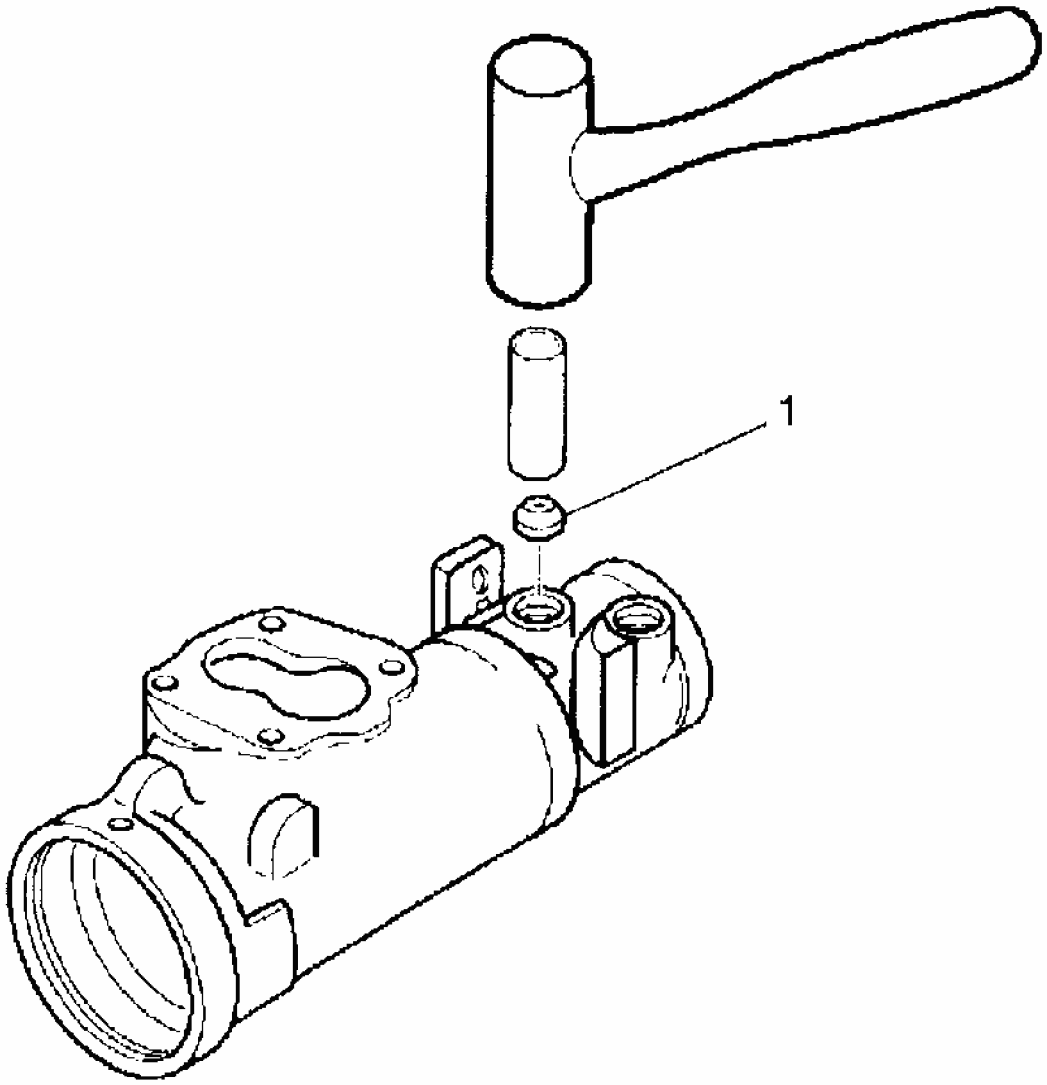

Fig. 186: Check Valve
Courtesy of GENERAL MOTORS CORP.

STEERING GEAR THRUST SUPPORT REPLACEMENT - OFF VEHICLE (700 GEAR)

Tools Required

- *J 42882* Adjuster Nut Socket
- *J 43435* Adjuster Lock Nut Wrench

Disassembly Procedure

1. Rotate the stub shaft back and forth in order to drain the power steering fluid.

2. Remove the coupling shield retainer and the lock nut from the steering gear housing using *J 43435* and a torque wrench.

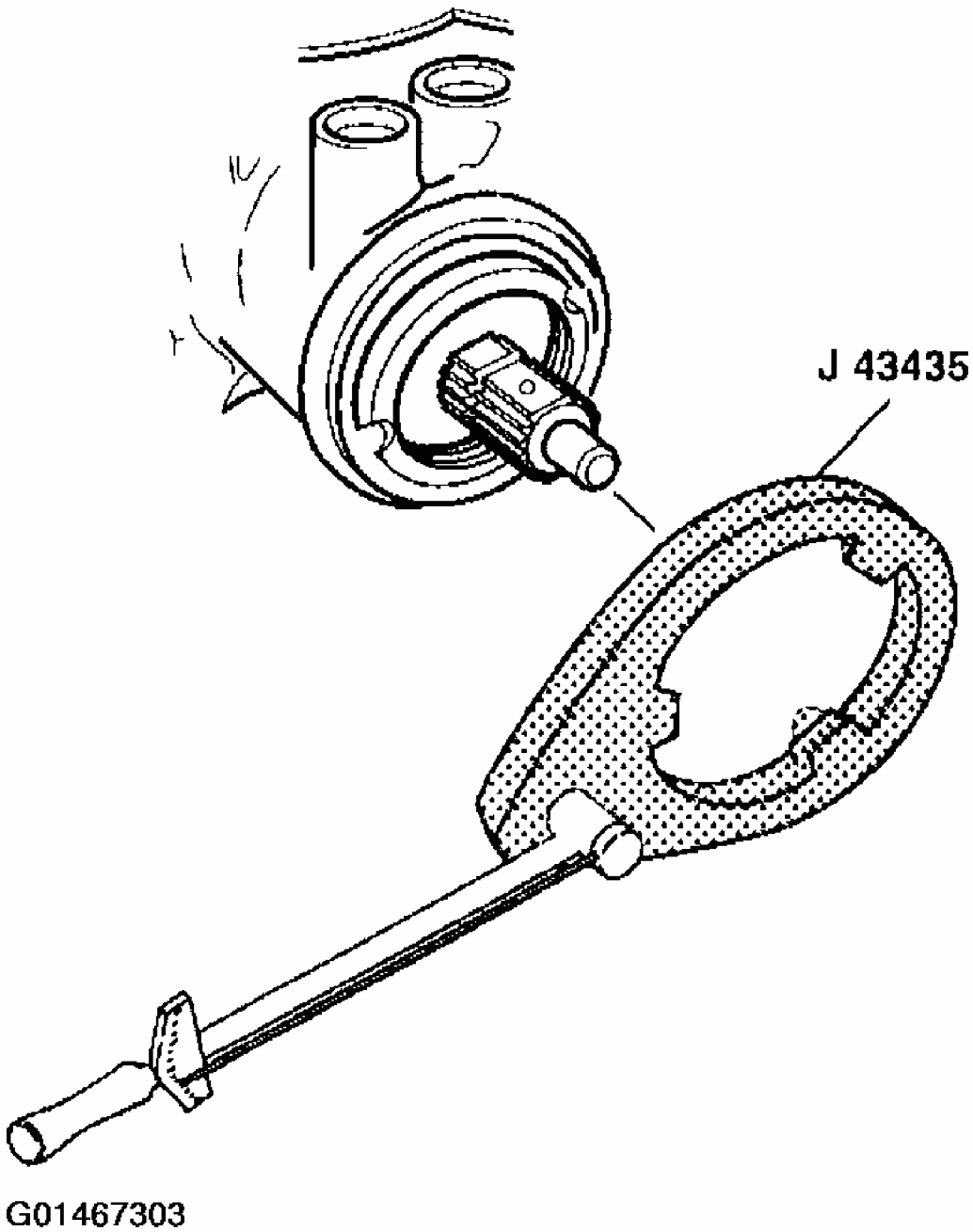

Fig. 187: Removing Coupling Shield Retainer & Lock Nut From Steering Gear Housing
Courtesy of GENERAL MOTORS CORP.

3. Remove the adjuster nut assembly (2) from the steering gear housing (1) using *J 42882* .

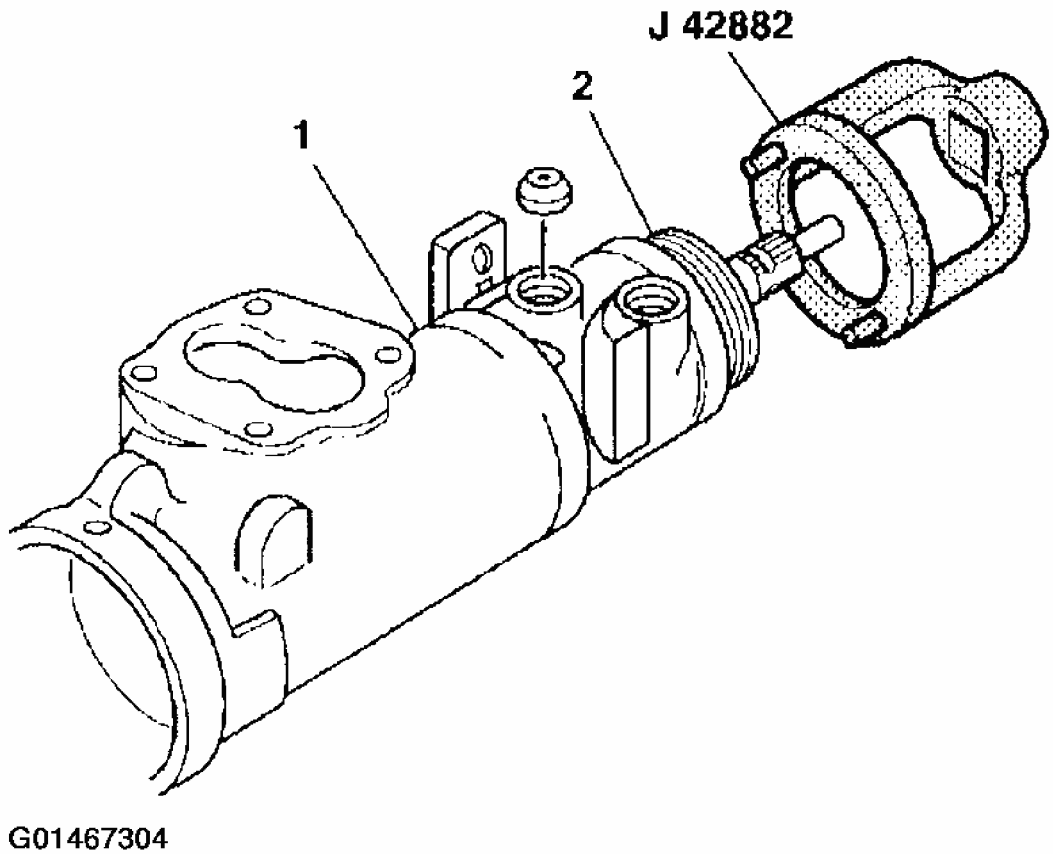

Fig. 188: Removing Adjuster Nut Assembly From Steering Gear Housing
Courtesy of GENERAL MOTORS CORP.

4. Remove the thrust support assembly (2) from the steering gear housing (1).
5. Remove the O-ring seal (3) from the thrust support assembly (2).

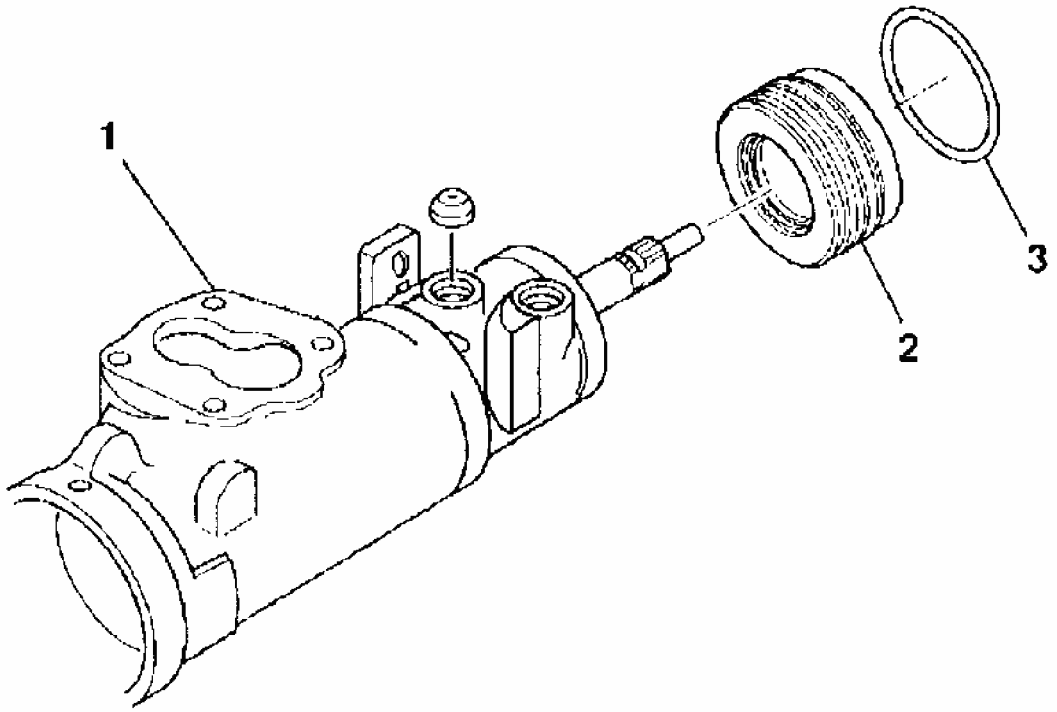

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Fig. 189: Removing Thrust Support Assembly & O-Ring Seal From Steering Gear Housing
Courtesy of GENERAL MOTORS CORP.

Assembly Procedure

Important: Install a new O-ring seal each time the thrust support assembly is removed from the steering gear.

1. Lubricate the new O-ring seal (3).
2. Install the new O-ring seal (3) on the thrust support assembly (2).
3. Install the thrust support assembly (2).

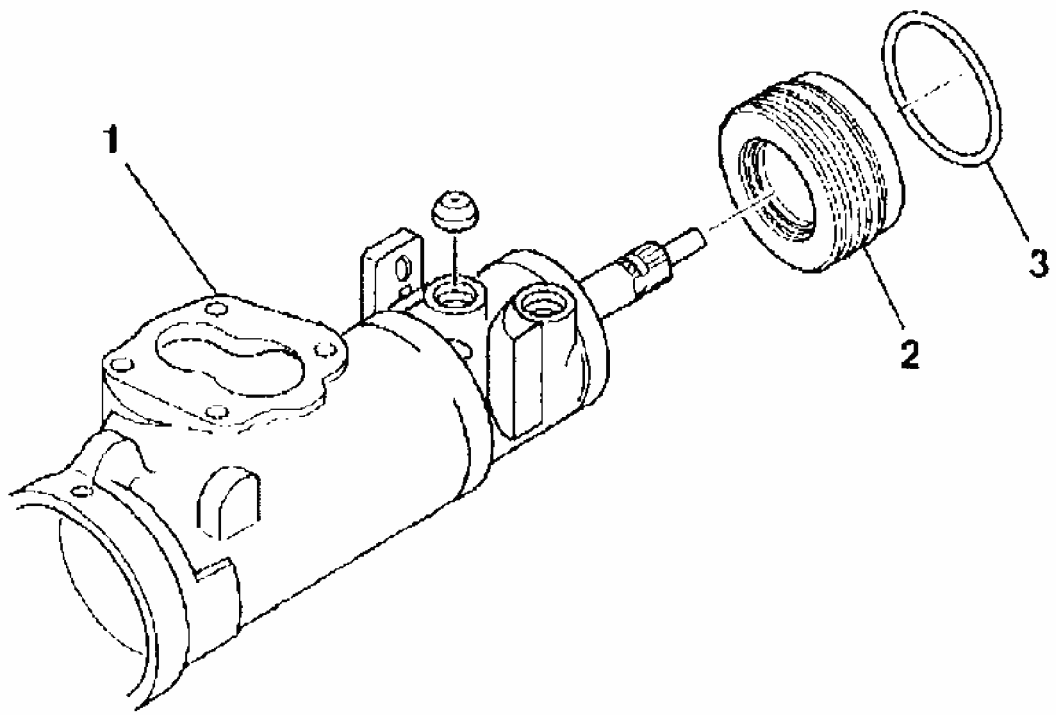


Fig. 190: Installing Thrust Support Assembly & O-Ring Seal To Steering Gear Housing
Courtesy of GENERAL MOTORS CORP.

4. Connect the adjuster nut assembly (2) to the steering gear housing (1) using *J 42882* .
5. Install the coupling shield retainer and the lock nut (1) to the adjuster nut assembly.
6. Refer to **WORM THRUST BEARING PRELOAD ADJUSTMENT - OFF VEHICLE (700 GEAR)** to adjust the thrust bearing preload.

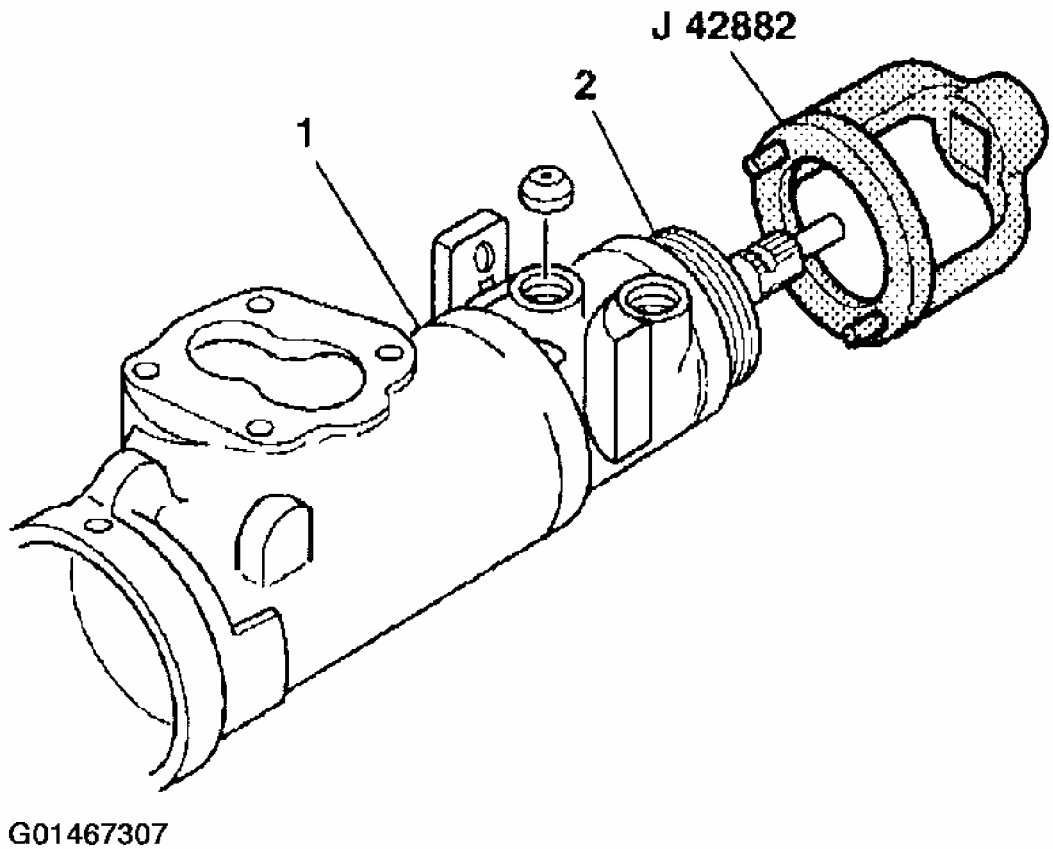


Fig. 191: Connecting Adjuster Nut Assembly To Steering Gear Housing
Courtesy of GENERAL MOTORS CORP.

7. Hold the adjuster nut assembly in position to maintain alignment of the marks.

NOTE: Refer to FASTENER NOTICE in Cautions and Notices.

8. Tighten the coupling shield retainer and the lock nut using *J 43435* and a torque wrench.

Tighten

Tighten the retainer and the lock nut to 109 N.m (80 lb ft).

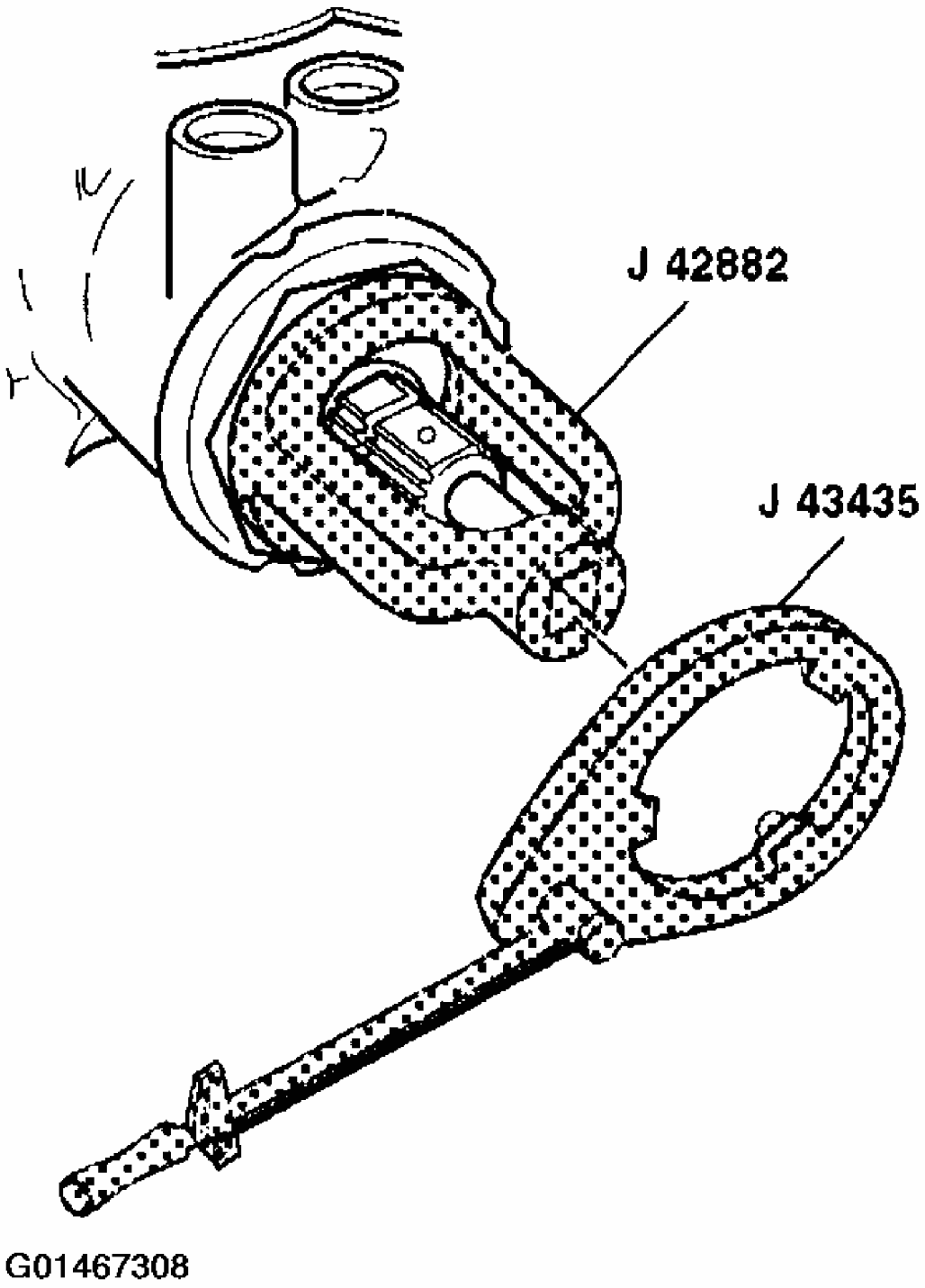


Fig. 192: Tightening Coupling Shield Retainer & Lock Nut
Courtesy of GENERAL MOTORS CORP.

DESCRIPTION AND OPERATION

POWER STEERING SYSTEM DESCRIPTION AND OPERATION

The hydraulic power steering pump is a constant displacement vane-type pump that provides hydraulic pressure and flow for the power steering gear. The hydraulic power steering pumps are either belt-driven or direct-drive, cam-driven.

The power steering fluid reservoir holds the power steering fluid and may be integral with the power steering pump or remotely located. The following locations are typical locations for the remote reservoir:

- Mounted to the front of the dash panel
- Mounted to the inner fender
- Mounted to a bracket on the engine

The 2 basic types of power steering gears are listed below:

- A recirculating ball system
- A rack and pinion system

In the recirculating ball system, a worm gear converts steering wheel movement to movement of a sector shaft. A pitman arm attached to the bottom of the sector shaft actually moves one tie rod and an intermediate rod move the other tie rod.

In the rack and pinion system, the rack and the pinion are the 2 components that convert steering wheel rotation to lateral movement. The steering shaft is attached to the pinion in the steering gear. The pinion rotates with the steering wheel. Gear teeth on the pinion mesh with the gear teeth on the rack. The rotating pinion moves the rack from side to side. The lateral action of the rack pushes and pulls the tie rods in order to change the direction of the vehicle's front wheels.

The power steering pressure hose connects the power steering pump union fitting to the power steering gear and allows pressurized power steering fluid to flow from the pump to the gear.

The power steering return hose returns fluid from the power steering gear back to the power steering fluid reservoir. The power steering return line may contain an integral fin-type or line-type power steering fluid cooler.

In a typical power steering system, a pump generates hydraulic pressure, causing fluid to flow, via the pressure hose, to the steering gear valve assembly. The steering gear valve assembly regulates the incoming fluid to the right and left chambers in order to assist in right and left turns.

Turning the steering wheel activates the valve assembly, which applies greater fluid pressure

and flow to 1 side of the steering gear piston, and lower pressure and flow to the other side of the piston. The pressure assists the movement of the gear piston. Tie rods transfer this force to the front wheels, which turn the vehicle right or left.

SPECIAL TOOLS & EQUIPMENT

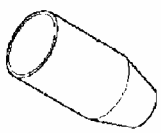
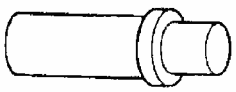
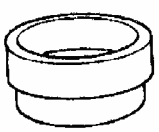
Illustration	Tool Number/Description
	J 4245 Internal Snap Ring Pliers
	J 6219 Pitman Shaft Oil Seal Installer
	J 6222-A Shaft Seal Protector
	J 6278 Pitman Shaft Bearing Remover and Installer
	J 8947 Rack Piston Teflon Ring Compressor

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Fig. 193: Special Tools & Equipment (1 Of 4)

Courtesy of GENERAL MOTORS CORP.

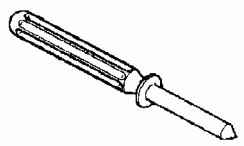
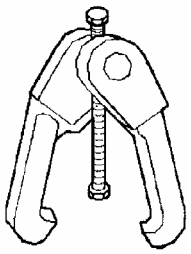
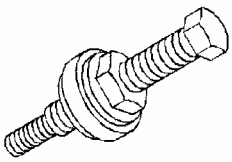
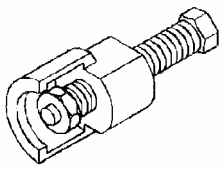
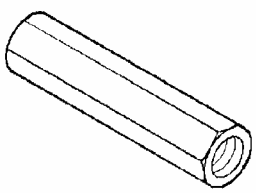
Illustration	Tool Number/Description
	J 21552 Rack Piston Arbor
	J 24319-B Steering Linkage and Tie Rod Puller
	J 25033-C Power Steering Pump Pulley Installer
	J 25034-C Power Steering Pump Pulley Remover
	J 29193 Steering Linkage Installer (12 mm)

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Fig. 194: Special Tools & Equipment (2 Of 4)
Courtesy of GENERAL MOTORS CORP.

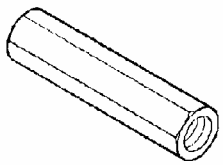
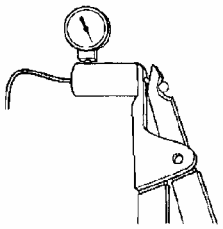
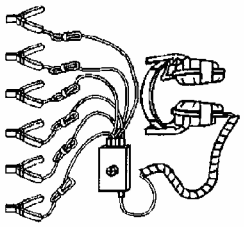
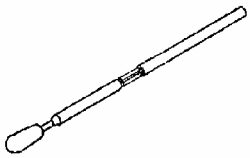
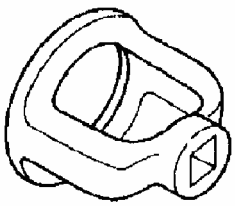
Illustration	Tool Number/Description
	J 29194 Steering Linkage Installer (14 mm)
	J 35555 Mity Vac
	J 39570 Chassis Ear
	J 42640 Steering Column Anti-Rotation Pin
	J 42882 Adjuster Nut Socket

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Fig. 195: Special Tools & Equipment (3 Of 4)
Courtesy of GENERAL MOTORS CORP.

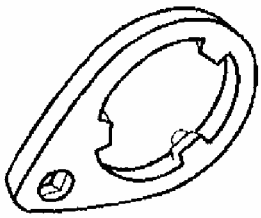
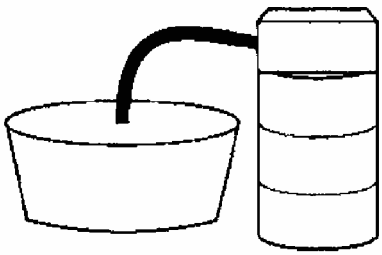
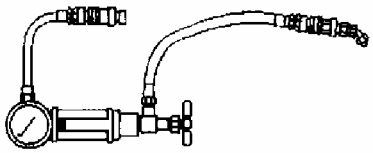
Illustration	Tool Number/Description
	J 43435 Adjuster Lock Nut Wrench
	J 43485 Power Steering Bleeder Adapter
	J 44721 Power Steering System Analyzer

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Fig. 196: Special Tools & Equipment (4 Of 4)
Courtesy of GENERAL MOTORS CORP.